SERVICE MANUAL

727

SPECTRUM ANALYZER

REVISION A

ALTECH
A CUTLER-HAMMER COMPANY
CONTROL
815 BROADHOLLOW ROAD • FARMINGDALE, NEW YORK 11735

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WARRANTY

Except for tubes, fuses, and batteries which carry no warranty, Cutler-Hammer, in connection with equipment sold, agrees to correct any defect in workmanship or material which may develop during the period of one year from the date of shipment under proper or normal use and not in excess of the original manufacturer's life expectancy ratings, by its option to repair or replace, FOB point of shipment, the defective part or parts, and such correction shall constitute a fulfillment of all Cutler-Hammer liabilities in respect to said apparatus.

February 1976

FOREWORD

The AILTECH 727 Spectrum Analyzer handbook information is divided into two applicable manuals. These are:

OPERATING MANUAL

Contains general information relating to the operational characteristics of the instrument.

SERVICE MANUAL

Contains all information required to service and maintain the instrument. Includes schematic diagrams, trouble-shooting procedures, and replaceable parts list.

ADDITIONAL SERVICE

Additional service information can be made available by calling AILTECH at 516-595-6478

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WARNING

SAFETY

To avoid the possibility of injury or death, the following precautions must be followed before the instrument is switched on:

- If this instrument is to be energized via an autotransformer for voltage reduction, make sure that the common terminal is connected to the earthed pole of the power source.

- The power cable plug shall be inserted into a socket outlet provided with a protective earth contact. The protective action must not be negated by the use of an extension cord without a protective conductor (grounding).

- Before switching on the instrument, the protective earth terminal of the instrument must be connected to a protective conductor of the power cord. This is accomplished by ensuring that the instrument's internal earth terminal is correctly connected to the instrument's chassis and that the power cord is wired correctly.

- Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

- Any interruption of the protective (grounding) conductor inside or outside the instrument or disconnection of the protective earth terminal is likely to make the instrument dangerous. Intentional interruption is prohibited.

HIGH VOLTAGE

- Any adjustment, maintenance, and repair of the opened instrument under voltage should be avoided as much as possible and, if inevitable, should be carried out only by a skilled person who is aware of the hazard involved.

- Exercise extreme care when servicing the display unit. Voltages in excess of 7000 volts are used.

- Handle CRT's very carefully to avoid implosion.

- Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

FUSES

- Fuses are used in both sides of the AC line. Make sure that only fuses with the required rated current and of the specified type (normal blow, time delay, etc.) are used for replacement. The use of repaired fuses and the short-circuiting of fuse-holders must be avoided.

CAUTION

GROUNDING

- Any interruption of the protective (grounding) conductor inside or outside the instrument is likely to cause damage to the instrument. To avoid damage, this instrument and all line powered devices connected to it must be connected to the same earth ground.

LINE VOLTAGE

- Be sure to select the correct fuse rating for the selected line voltage. Fuse ratings are listed on the instrument near the fuse holders.

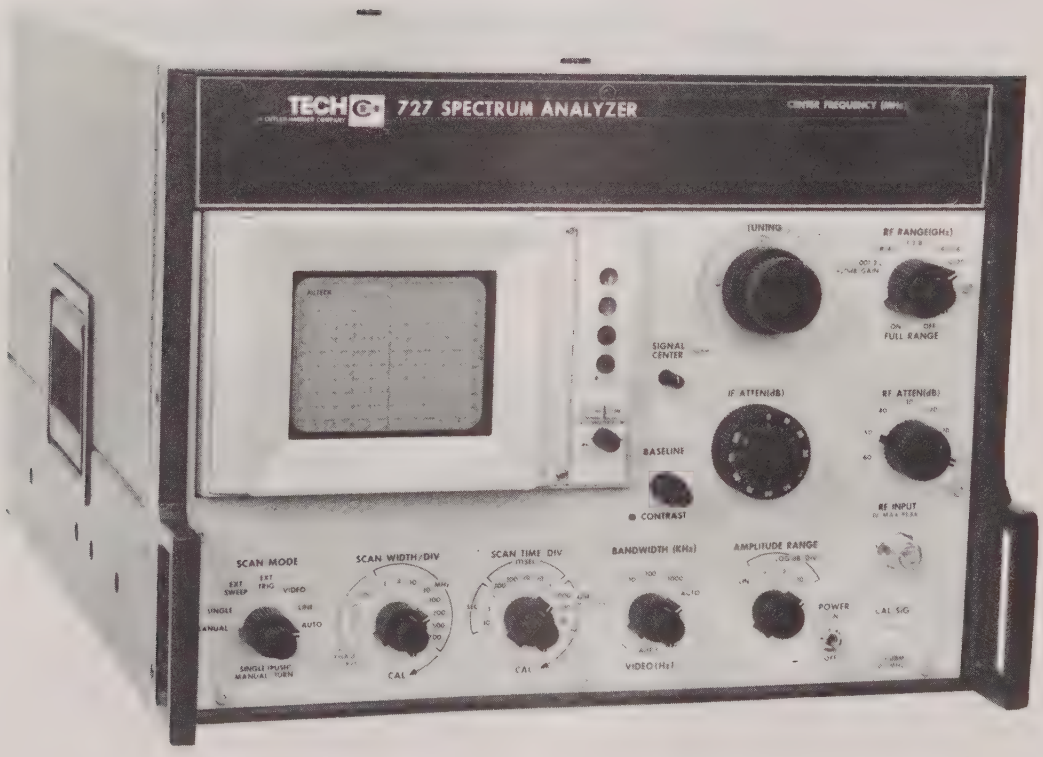
- To prevent damage to the instrument, make the line voltage selection before connecting line power. Also ensure that the line power cord is connected to a line power socket that is provided with a protective earth contact.

SAFETY

- To avoid the possibility of damage to test equipment, read completely through each section before starting it. Make any preliminary control settings necessary for correct test equipment operation.

SEMI-RIGID COAX

- Do not torque the RF connectors to more than 5 inch-pounds.



AILTECH 727 Series Spectrum Analyzers

CHAPTER 1

GENERAL INFORMATION

1-1. SCOPE

This manual provides service information for the AILTECH 727 Spectrum Analyzer. Information relative to ordering parts is also included. A separate manual is provided for the operation procedures for the Spectrum Analyzer as is explained in the Foreword.

1-2. POWER REQUIREMENTS

The AILTECH 727 Spectrum Analyzer is operated on either 115 or 230 Vac at 50 to 60 Hz. The 115/230-volt slide switch on the rear of the instrument must be in the correct position to avoid damage to the instrument. When shipped, the instrument is set for the line voltage anticipated at the destination. This should be verified before applying power. Fuses should be changed when changing line voltages. The power requirement is about 220 watts.

1-3. GROUNDING REQUIREMENTS

To protect operating personnel, the National Electrical Manufacturer's Association (NEMA) recommends that the instrument panel and cabinet be grounded. This instrument is equipped with a three conductor power cable which, when plugged into an appropriate receptacle, grounds the instrument. The offset pin on the power cable three-prong connector is the ground wire.

1-4. PACKAGE DESCRIPTION

The AILTECH 727 Spectrum Analyzer is designed for ease of servicing. Most adjustments for calibration and alignment are accessible with top cover removed. All subassemblies have modular construction for easy service and repair.

The AILTECH 727 Spectrum Analyzer has four principle subassemblies. These are: (1) the display module which can be independently removed through the front panel; (2) the RF deck which swings out from under the unit when the bottom cover is removed; (3) the main frame which houses most video boards, the low voltage power supply, the log IF amplifier; and (4) the front panel and harness assembly. This construction makes all subassemblies accessible to the service personnel. Figure 1-1 shows the location of the subassemblies within the instrument.

1-5. OPERATING ENVIRONMENT

The operating environment should be within the following limitations:

Temperature	0° to 55°C
Humidity	95% RH @ 40°C

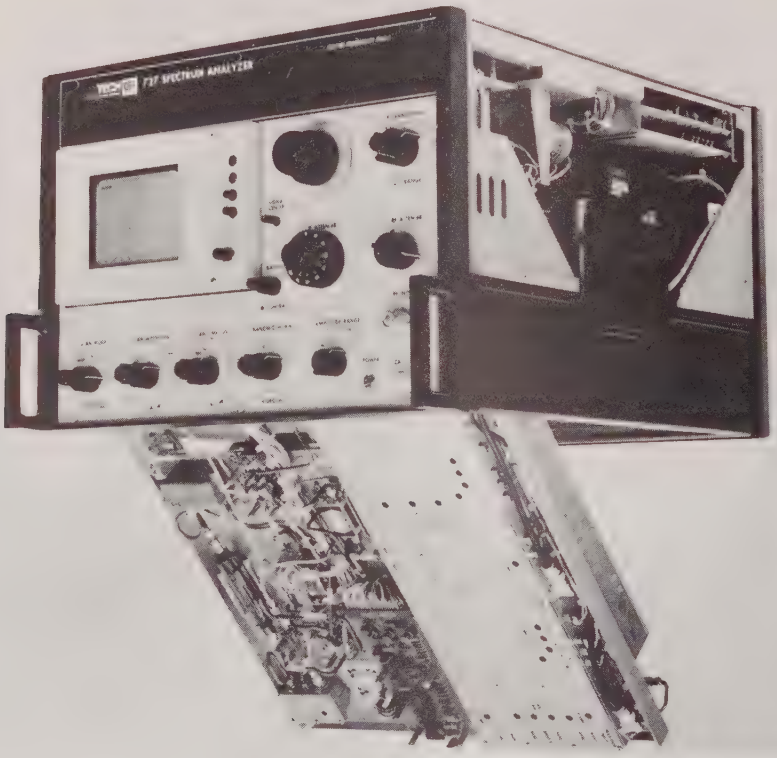


Figure 1-1. AILTECH 727 Spectrum Analyzer Subassembly Location

A forced air cooling system is used to maintain the operating temperature inside the instrument. The air intake and filter is located on the rear panel and should be cleaned regularly.

When operating the instrument, choose a location that provides at least 3 inches of clearance between the instrument and any obstruction.

1-6. PREPARATION FOR USE

1-7. UNPACKING

No special instructions are necessary when unpacking the AILTECH 727 Spectrum Analyzer. Reasonable care should be taken in removal of the unit from the shipping container.

1-8. INSPECTION FOR SHIPPING DAMAGE

Inspect the shipping container for signs of shipping damage. If the container is damaged, a detailed examination of the Spectrum Analyzer is required. Remove the upper and lower cover plates and examine the interior for damage, including components jarred loose during shipment.

CAUTION

The AILTECH 727 Spectrum Analyzer should not be operated with LINE VOLTAGE SELECT switch on the rear panel in the wrong position. Operation with the switch in the wrong position may cause incorrect operation or damage to the Spectrum Analyzer.

1-9. INSTALLATION

The AILTECH 727 Spectrum Analyzer can be operated from either 115 volts or 230 volts. Determine that the LINE VOLTAGE SELECT switch on the upper left corner of the rear panel is correctly set. If it is necessary to change the position of the LINE VOLTAGE SELECT switch, proceed as follows:

a. Disconnect power cable from connector P1.

b. Remove the two screws holding the locking plate in place.

c. Slide the switch to the correct position.

d. Reinstall the locking plate removed in step b.

Check that the correct fuses are installed: for 115 volts, install 3A slo-blow fuses; for 230 volts, install 1.5A slo-blow fuses. Connect power cable to connector P1 on the rear of the panel. Ensure that the supplied coaxial patch cable is connected between 21.4 INPUT and 21.4 OUTPUT jacks.

1-10. COOLING

The cooling fan mounted on the rear panel of the Spectrum Analyzer transports cool air through the device, maintaining correct temperatures within the unit.

1-11. PREPARATION FOR RESHIPMENT

1-12. PACKING

The Spectrum Analyzer shall be packaged in a manner that affords maximum protection against shock, vibration, and humidity.

1-13. OPTIONS (002, 003 AND 045)

Certain optional circuitry is available with all models of the 727 Spectrum Analyzer. These options are described in detail in the Appendix.

CHAPTER 2

THEORY OF OPERATION

2-1. BASIC OPERATING PRINCIPLES

The AILTECH 727 Spectrum Analyzer consists of a superheterodyne receiver and a calibrated CRT display. The receiver may be manually tuned to a fixed frequency or swept tuned through a selected frequency interval. Figure 2-1 is the simplified block diagram of the instrument.

The linear ramp generator provides the horizontal deflection signal for the CRT and the tuning voltages for the preselector and voltage-tuned local oscillator. The inherent linearity of the YIG-tuned preselector and voltage-tuned local oscillator ensure that frequency tuning is linear with respect to horizontal deflection of the CRT. The same linearity also ensures that the preselector frequency is maintained at a fixed interval from the voltage-tuned local oscillator frequency, that interval being the first intermediate frequency.

When a signal is passed through the preselector, it is mixed with the output of the voltage-tuned local oscillator to provide an output at the intermediate frequency. The signal is amplified, detected, and applied to the vertical deflection plates of the CRT. Since the horizontal deflection is proportional to frequency, the display is a plot of amplitude versus frequency of the applied signal.

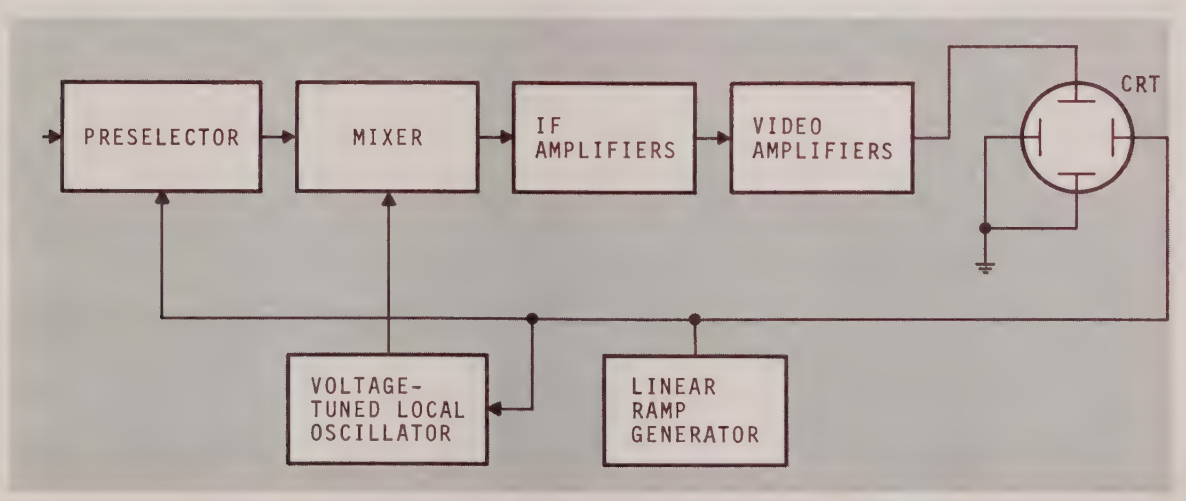


Figure 2-1. AILTECH 727 Spectrum Analyzer Simplified Block Diagram

2-2. THEORY OF OPERATION

Figure 2-2 is the block diagram of the AILTECH 727 Spectrum Analyzer.

The signal is first applied to the RF attenuator. The RF attenuator provides 60 dB of attenuation in 10-dB steps. It is used to reduce the signal level so that spurious signal generation within the AILTECH 727 is minimized. In general, the signal at the output of the RF attenuator should not exceed -10 dBm. For maximum sensitivity, it is left in the 0-dB position.

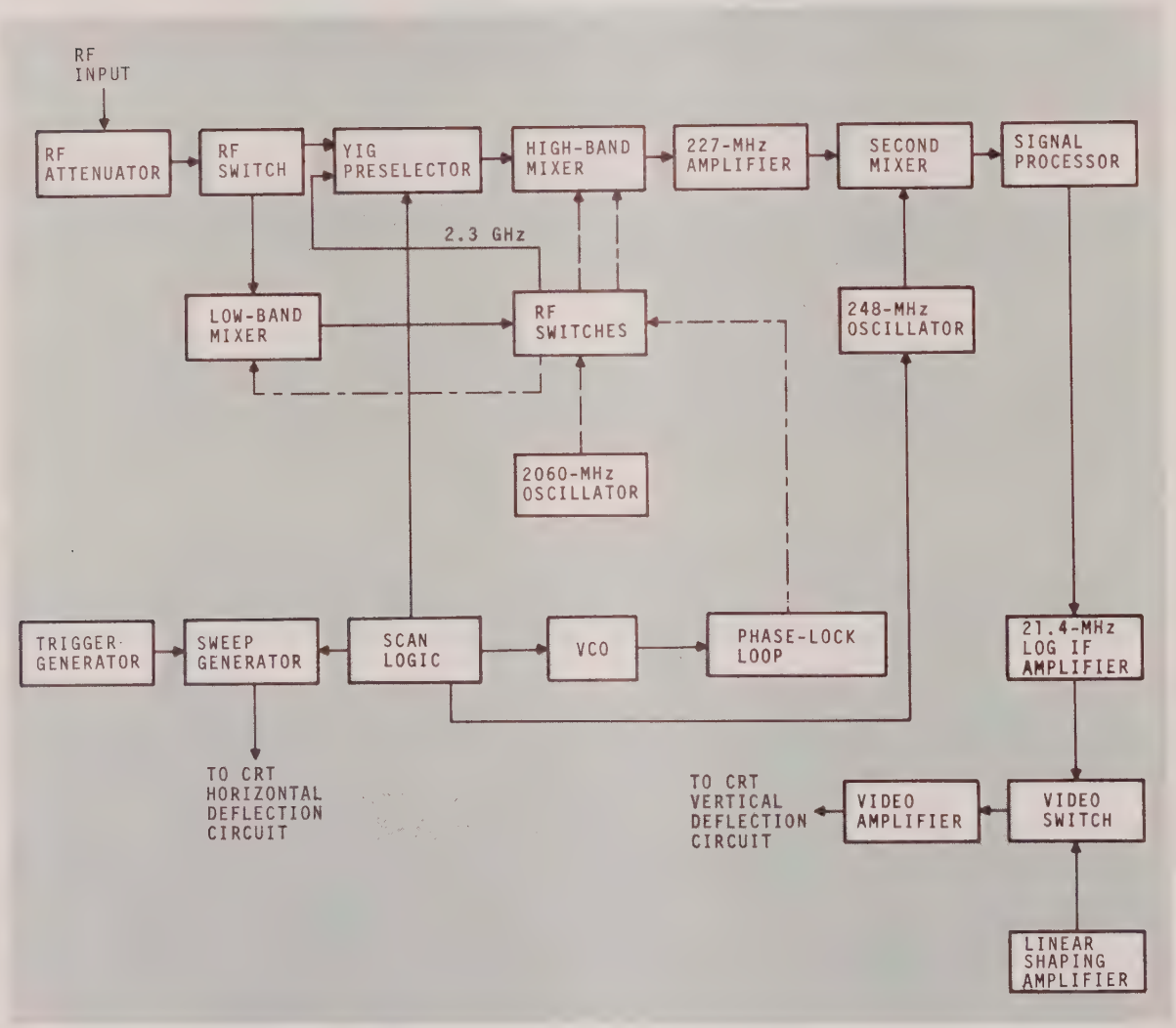


Figure 2-2. AILTECH 727 Spectrum Analyzer Functional Block Diagram

Following the RF attenuator is one section of the RF RANGE switch. If the low band (0.001 to 2.0 GHz) is selected, the signal is mixed with the output of the swept VCO and up-converted to 2.29 GHz. The YIG preselector is fixed-tuned to this frequency. The signal is then applied to the high-band mixer and mixed with a crystal-controlled 2060-MHz signal to derive the 227 MHz first intermediate frequency. If any other RF range is selected, the signal is applied directly to the YIG preselector and mixed with the output of the swept VCO in the high-band mixer.

The preselector is a YIG filter capable of being electronically tuned from 1.8 to 20 GHz. Offset and sweep logic circuits in the scan logic ensure that the center frequency of the voltage-tuned local oscillator is always 227 MHz greater than the YIG preselector frequency. The purpose of the YIG preselector is to prevent the generation of on-screen image signals without having to resort to microwave intermediate frequencies or a large number of narrow bands to ensure a single mode of mixing within each band.

The VCO is capable of being electronically tuned from 1.7 to 4.3 GHz. When the SCAN WIDTH switch is in a MHz position, the VCO is swept over the selected scan width. When the SCAN WIDTH switch is in a kHz position, the VCO is automatically stabilized and operates at a fixed frequency. Scanning is then done by the 248-MHz oscillator.

After down-conversion, the signal is amplified and applied to the second mixer. This mixer is driven by the 248-MHz oscillator and provides an output at 21.4 MHz. When the SCAN WIDTH switch is in a MHz position, the second LO operates at a fixed frequency. When a kHz scan is selected, this oscillator is swept over the selected interval.

The 21.4-MHz signal is then applied to a signal processor made up of an IF attenuator, an IF bandwidth selector, and an automatic gain compensation network. The attenuator is used to adjust the amplitude of the display. It consists of two sections, one providing 100 dB in 10-dB steps, the other providing 10 dB in 1-dB steps. Four IF bandwidths are provided. These are determined by four sets of filters selectable from the front panel.

The AILTECH 727 Spectrum Analyzer utilizes harmonic mixing to obtain operation at the three higher RF ranges (3.3 to 20 GHz). The conversion efficiency of the first mixer is poorer in these harmonic mixing modes than for fundamental mixing. The automatic gain compensation network senses the RF range to which the AILTECH 727 is tuned and inserts or removes attenuation to maintain the overall gain constant with frequency.

Signal amplitudes are usually measured in logarithmic units (dB). Because of this, final IF amplification is provided by a wide-range 21.4-MHz log amplifier. This amplifier employs the successive limiting technique and converts linear IF to logarithmic video. The conversion is such that the amplifier's response is within ±2 dB over a full 100-dB dynamic range.

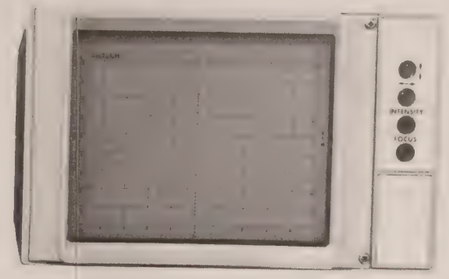
If the AMPLITUDE RANGE switch on the front panel is set to one of the LOG positions, the output of the 21.4-MHz log IF amplifier is applied directly to the video amplifier. However, some measurements are more convenient with a linear display. Placing the AMPLITUDE RANGE switch in the LIN (linear) position routes the signal through a shaping amplifier that restores the linear amplitude response.

Additional filtering is provided in the video amplifier. The signal is then further amplified and applied to the vertical deflection plates of the CRT.

2-3. CONTROLS AND INDICATORS

Figure 2-3 identifies and describes the controls and indicators on the front panel of the AILTECH 727. Figure 2-4 identifies and describes the controls, input and output jacks, and fuses on the rear panel.

MODEL 72712



MODEL 72710

MODEL 72711

Figure 2-3. Front Panel Controls and Indicators (Sheet 1 of 2)

Reference No.	Nomenclature and Function
1	SIGNAL CENTER control Push-to-turn continuous control adjusts the center frequency in MHz increments when operating at kHz scan widths. Acts as a fine frequency vernier and amplitude peaker by allowing user direct access to main LO and preselector. This eliminates any amplitude degradation caused by poor tracking of the preselector with the main LO.
2	TUNING control Sets the center frequency of the interval being scanned. Outer knob is for coarse tuning; inner-knob is mechanically reduced for fine tuning. Sets marker frequency in FULL RANGE scan mode.
3	CENTER FREQUENCY (MHz) readout Indicates center frequency of the interval being scanned or marker frequency in FULL RANGE scan mode.
4	RF RANGE (GHz) switch Switch selects frequency limits of the spectrum being scanned as follows: 0.001 - 2.0 GHz 1.8 - 4.0 GHz 3.3 - 8.3 GHz 5.4 - 12.4 GHz 10.0 - 20.0 GHz
5	FULL RANGE switch Two-position switch concentric with the RF RANGE (GHz) switch. In the ON position the analyzer scans the entire spectrum indicated by the RF RANGE (GHz) switch setting. In the OFF position, spectrum width reverts to the SCAN WIDTH/DIV switch setting.
6	IF ATTEN (dB) switch Step attenuator adjusts display amplitude. Outer ring provides 100-dB attenuation in 10 -dB steps; inner knob provides 10-dB attenuation in 1-dB steps.
7	RF ATTEN (dB) switch Attenuates RF input signal. Provides 60-dB attenuation in 10-dB steps.
8	RF INPUT jack Precision type N female connector: input for signals in the range from 0.001 to 20.0 GHz.
9	CALIBRATE SIGNAL Supplies a -30 dBm ±.5 dB signal @ 100 MHz.

10 POWER switch

On-off switch for primary power.

11 AMPLITUDE RANGE switch

Four-position switch selects logarithmic amplitude display (LOG) with sensitivities of 2, 5, or 10 dB/DIV of vertical deflection or linear amplitude display (LIN).

12 BANDWIDTH (kHz) switch

Five-position switch manually selects IF bandwidths of 1, 10, 100, and 1000 kHz, or, in the AUTO position, the analyzer automatically selects the best available IF bandwidth for the combination of SCAN TIME/DIV and SCAN WIDTH/DIV in use.

13 BANDWIDTH (kHz) VIDEO switch

Three-position switch, concentric with the BANDWIDTH (kHz) switch for manual selection of the bandwidths of 10 and 500 Hz. or, in the AUTO position, the analyzer automatically selects 5 kHz, 25 kHz, 150 kHz, 1000 kHz or whichever is the best available bandwidth for the IF bandwidth in use.

14 SCAN TIME/DIV switch

Eleven-position switch selects eight calibrated scan times from 10 seconds to 300 msec per division or, three calibrated sweep times of 10, 100, and 1000 μsec per division for zero scan width (time domain) displays.

15 SCAN TIME vernier

Concentric control for interpolation. Scan or sweep times are calibrated when the vernier is fully clockwise.

16 SCAN WIDTH/DIV switch

Fourteen-position switch selects calibrated scan widths from 1 kHz to 700 MHz per division in a 1, 3, 10 sequence and 200, 500, and 700 MHz per division.

17 SCAN WIDTH vernier

Concentric control continuously adjusts scan width from zero to the setting of the SCAN WIDTH/DIV switch. Scan widths are calibrated when the vernier is fully clockwise.

18 SCAN MODE switch

Seven-position switch selects trigger mode for internal scan or an external sweep signal as follows:

AUTO:	Recurrent scan, internally generated
LINE:	Scan triggered by the ac line
VIDEO:	Scan triggered by the detected RF input signal
EXT TRIG:	Scan triggered by an external +2 volt minimum signal
SINGLE:	Single scan initiated by concentric SINGLE pushbutton switch.
EXT SWEEP:	Requires external 0 to +6 volts signal for 10 division left-to-right horizontal deflection
MANUAL:	Allows manual scanning by use of the concentric MANUAL vernier.

19 SINGLE/MANUAL switch

Pushbutton concentric with SCAN MODE switch. SINGLE pushbutton indicates single scan. MANUAL vernier allows manual scanning.

20 CONTRAST control

Adjusts intensity of the clipped portion of the display.

21 BASELINE control

Adjusts baseline clipping level.

22 Display Unit Controls

Refer to applicable display manual for a description of the display unit controls which is located in the rear of the Service Manual.

DISPLAY

VERTICAL POSITION control (↕)

Screwdriver control for vertical position adjustment.

HORIZONTAL POSITION control (⟷)

Screwdriver control for horizontal adjustment.

OPERATE LEVEL

Controls the sensitivity to the writing beam and brightness of the stored display.

INTENSITY

Controls the display brightness in the non-storage mode.

FOCUS

Provides adjustment to give a well defined display.

ERASE

Momentary pushbutton that initiates the erasure of all stored information.

STORE*

A Push Switch that initiates the storage operation.

PERSISTENCE/SAVE**

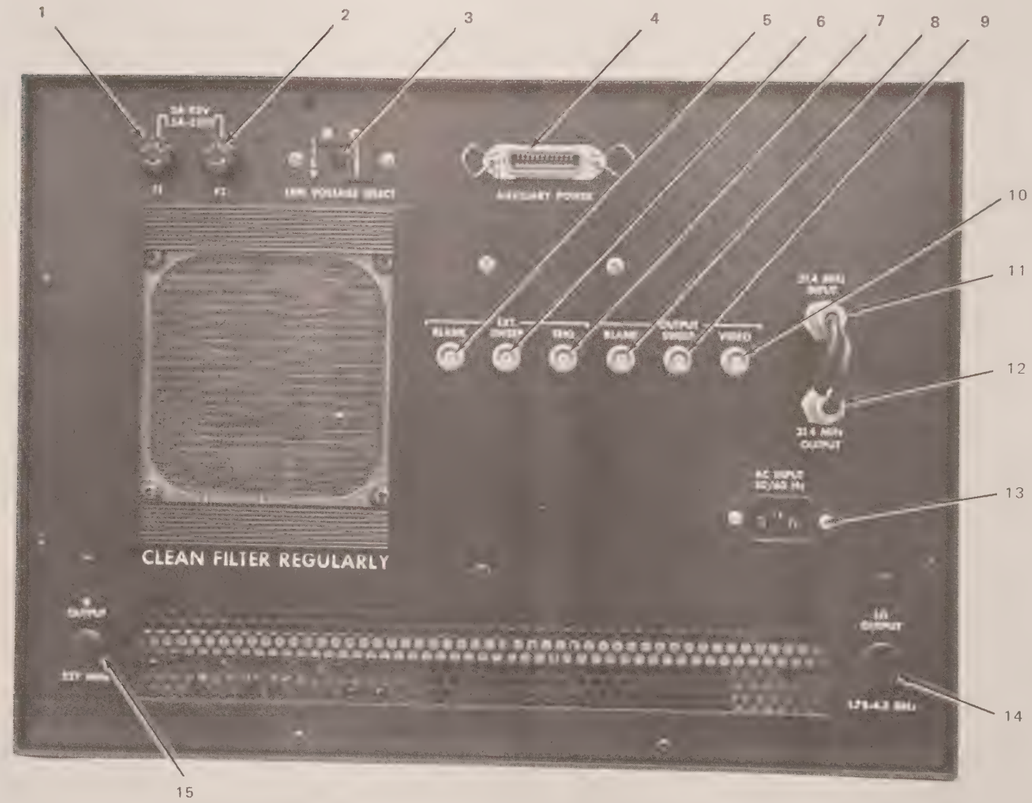
This switch controls the persistence level. Turning this switch counterclockwise increases the persistence which gives a longer retention to the display. Therefore turning the control clockwise will decrease the time a stored signal is retained. To retain the stored trace pull the switch out and turn it as required to retain the display at a convenient intensity level.

*72711, 12
**72711 only

Figure 2-3. Front Panel Controls and Indicators (Sheet 2 of 2)

Reference No.	Nomenclature and Function
1	FUSE (F1) Main power fuse (3 ampere/115 volt, 1-1/2 ampere/230 volt)
2	FUSE (F2) Main power fuse (3 ampere/115 volt, 1-1/2 ampere/230 volt)
3	LINE VOLTAGE SELECT Two-position switch for 115 or 230 volt use
4	AUXILIARY POWER Used in conjunction with tracking generator or additional display monitor. See wiring diagram for signals and voltages.
5	EXT BLANK External blanking input to blank during retrace (+5 volts required)
6	EXT SWEEP External sweep input (0 to 6 volt ramp positive-going for left-to-right sweep required)
7	EXT TRIG External trigger input to initiate sweep, 1 volt positive required; triggers on positive going transition
8	BLANK OUTPUT Output voltage during retrace (greater than +2 volts)
9	SWEEP OUTPUT Output voltage proportional to horizontal sweep (0 to 6 volt ramp, positive-going for left-to-right sweep)
10	VIDEO OUTPUT Output voltage proportional to vertical deflection 1 volt (typical) = top of screen 0 volt = bottom of screen
11	21.4 MHz INPUT 21.4-MHz input to log amplifier
12	21.4 MHz OUTPUT 21.4-MHz linear output, 0 dBm (typical) = top of screen with -11 dBm input
13	AC INPUT 50/60 Hz Ac line cord input jack

14	LO OUTPUT (003 OPTION) See Appendix of Service Manual for detailed description
15	IF OUTPUT (002 OPTION) See Appendix of Service Manual for detailed description



NOTE: Items 11 and 12 must be connected by jumper for proper performance.

Figure 2-4. Rear Panel

CHAPTER 3

MAINTENANCE

3-1. INTRODUCTION

This chapter contains instructions for isolating malfunctions to a general functional area or component of the AILTECH 727. These instructions are based on the assumption that the reader is familiar with the operating procedures for the AILTECH 727 and the test equipment required to perform these procedures. The procedures are designed for a technician who is experienced in the operation and maintenance of this or similar equipment.

3-2. GENERAL INFORMATION

This section contains a functional description of some of the basic components of the AILTECH 727 circuitry. The information contained herein covers the operation of junction transistors, field effect transistors (FET), basic logic circuit elements, integrated circuits, and operational amplifiers. In order to better understand the troubleshooting procedures, it is advisable that this basic information be reviewed before proceeding.

3-3. BASIC JUNCTION TRANSISTOR

The basic junction transistor consists essentially of two PN junctions placed back to back. The transistor is a device that acts as a current amplifier. The three connections to the transistor are the emitter, the collector, and the base. The base region is generally very thin. In operation, the transistor is biased to perform its function. Biasing of the NPN type transistor is shown in Figure 3-1. Biasing of the PNP type transistor is shown in Figure 3-2.

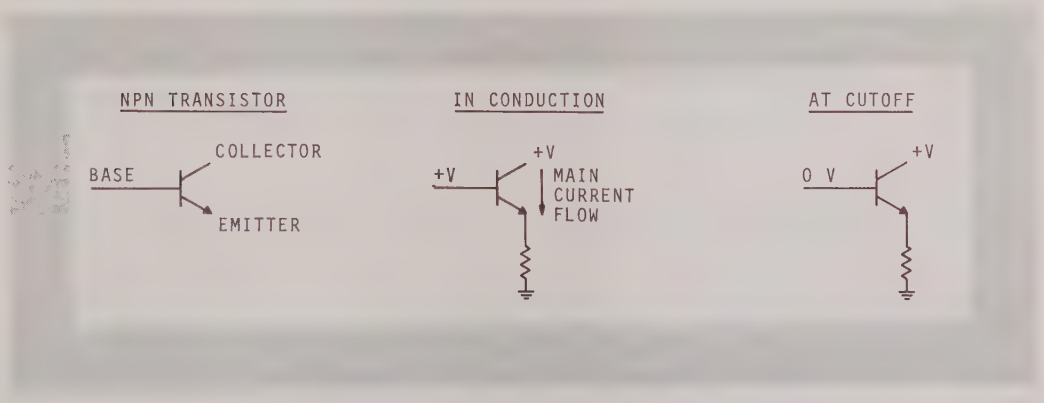


Figure 3-1. NPN Transistor Biasing

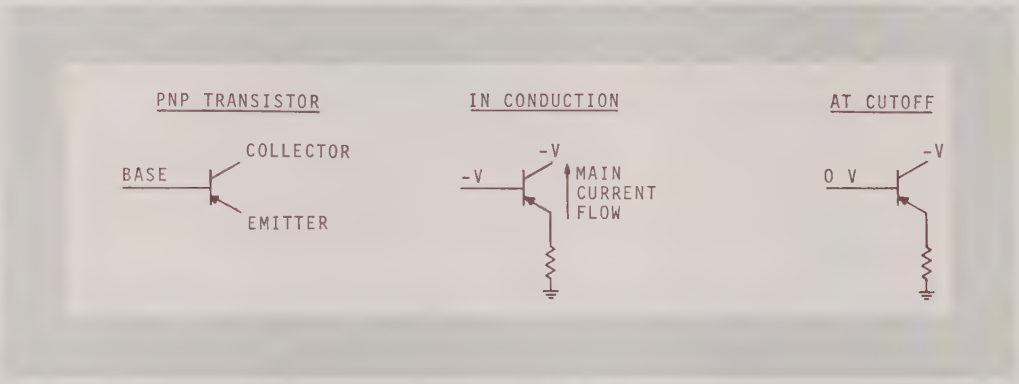


Figure 3-2. PNP Transistor Biasing

The most common cause of transistor failure is internal short circuits or internal open circuits. To check a transistor for shorts or opens, a standard ohmmeter is used. Before checking a transistor with an ohmmeter, be sure to check that the ohmmeter is on the proper scale since most ohmmeters can supply enough current or voltage to damage a transistor. Table 3-1 lists the most commonly available types of ohmmeters and the safe scale settings of each type; these scale settings must be used to avoid damaging the transistor under test.

In addition, the ohmmeter positive and negative probes should be used only as follows:

Transistor Type	Positive Probe	Negative Probe
NPN	Base	Emitter
	Base	Collector
PNP	Collector	Base
	Emitter	Base

The physical configuration of the different types of transistors used in the AILTECH 707 are shown in Figure 3-3.

3-4. FIELD EFFECT TRANSISTOR

The field effect transistor (FET) is a voltage-sensitive device which has an extremely high input impedance. Field effect transistors have three elements: the source, the drain, the gate (Figure 3-4). The conducting path between the source and the drain is called the channel. By placing a small positive potential on an N-channel drain, electrons will flow from the source to the drain. Therefore, the current flow will be from drain to source. Varying the gate voltage will result in a variation in channel width and resistance. Thus, it is the gate voltage variation that causes a change in the current drain, making the FET a voltage-sensitive device.

Table 3-1. Characteristics of Common Ohmmeters

Make, Model and Range	Open Circuit Voltage	Short Circuit Current	Polarity
Simpson 260			
R × 1	1.5 V	125 mA	Red ⊕
R × 100	1.5 V	1 mA	
R × 10K	7.5 V	60 μA	Black ⊖
Simpson 269			
R × 1	1.5 V	74 mA	
R × 10	1.5 V	8 mA	Red ⊖
R × 100	1.5 V	8 mA	Black ⊕
R × 1K	1.5 V	0.82 mA	
R × 10K	24 V	1.3 mA	
R × 100K	30 V	13 μA	
Triplett 630			
R × 1	1.5 V	320 mA	Red ⊖
R × 10	1.5 V	32 mA	Black ⊕
R × 100	1.5 V	3.25 mA	(Varies with serial number)
R × 1K	1.5 V	325 μA	
R × 100K	22.5 V	70 μA	
Triplett 310			
R × 1	1.5 V	7.5 mA	Red ⊖
R × 10	1.5 V	750 μA	Black ⊕
R × 100	1.5 V	75 μA	(Varies with serial number)
R × 10K	15 V	75 μA	

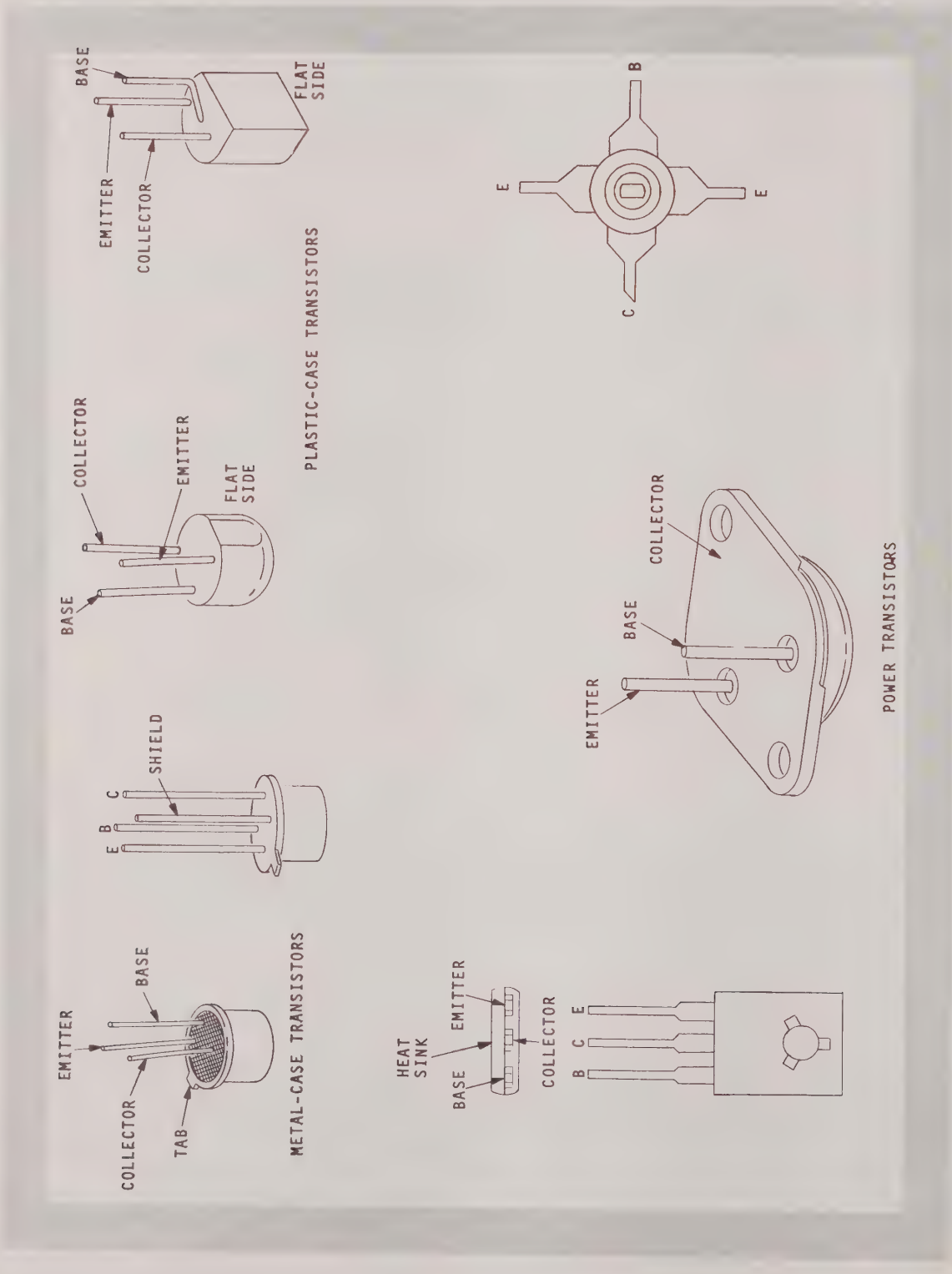


Figure 3-3. Transistor Types

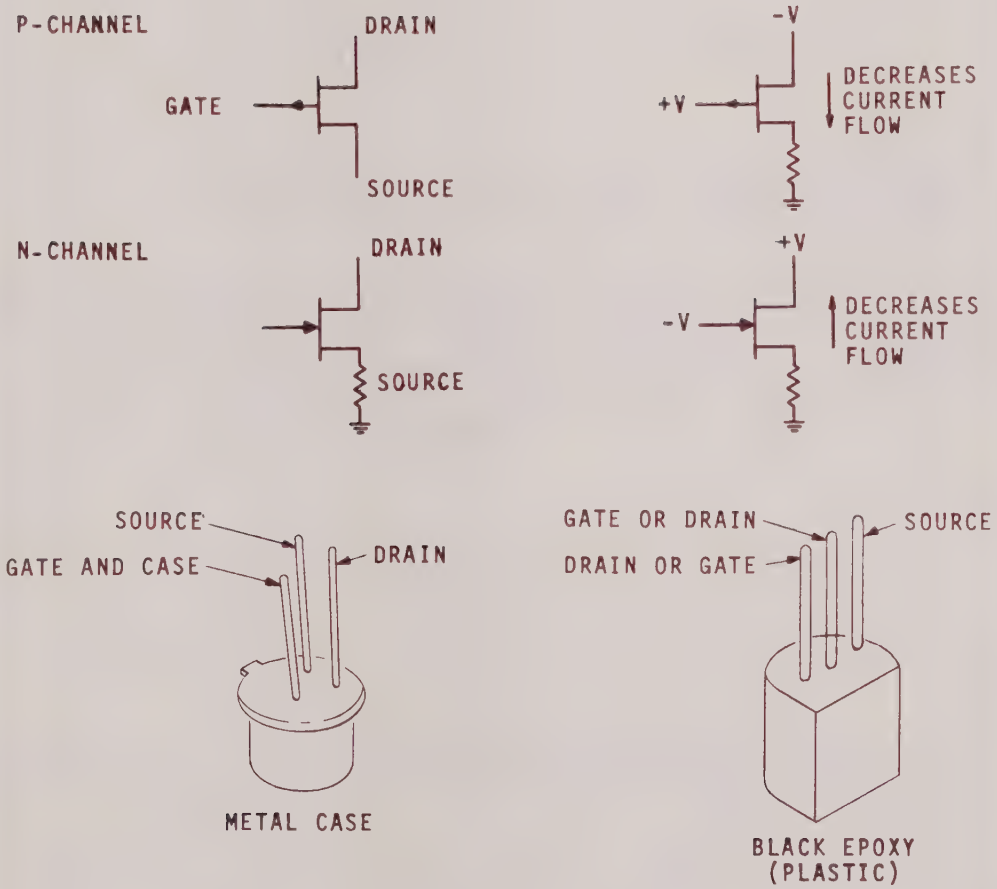
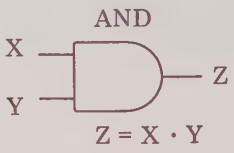


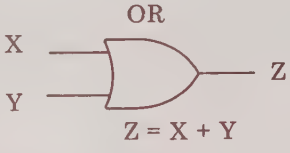
Figure 3-4. FET Biasing

3-5. BASIC LOGIC ELEMENTS

The two most basic forms of logic elements are the AND and OR gates. These are shown below with their respective truth tables.

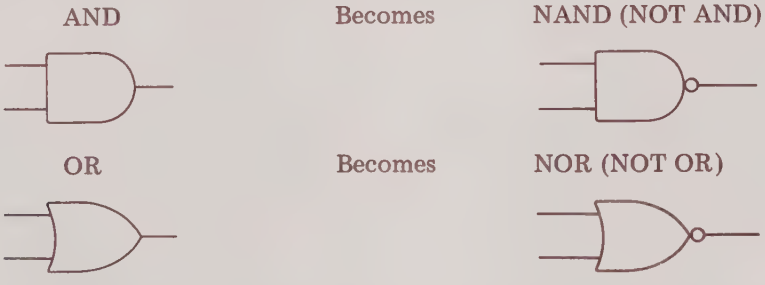


X	Y	Z
H	H	H
H	L	L
L	H	L
L	L	L

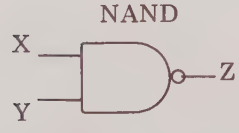


X	Y	Z
H	H	H
H	L	H
L	H	H
L	L	L

A NAND gate is an AND gate with its output inverted. Similarly, an OR gate becomes a NOR gate when its output is inverted. The same effect can be accomplished by inverting the inputs of each. To illustrate inversion or the input or output levels schematically, a circle is added to the appropriate line. For example:

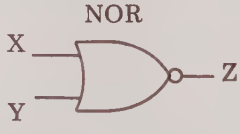


Typical NAND and NOR gates are shown below with their respective truth tables.



$Z = \overline{X \cdot Y}$

X	Y	Z
H	H	L
H	L	H
L	H	H
L	L	H



$Z = \overline{X + Y}$

X	Y	Z
H	H	L
H	L	L
L	H	L
L	L	H

An inverter performs a logic level inversion of its input signal. A one-input inverter is shown below with its truth table.

X	Z
H	L
L	H

3-6. INTEGRATED CIRCUITS

Basic logic gates are grouped in various combinations to form integrated circuit chips. Figure 3-5 shows the physical configuration of some typical integrated circuit chips used in the AILTECH 727.

3-7. OPERATIONAL AMPLIFIERS

Operational amplifiers are used to implement several functions. They are used as summers, regulators, buffers, amplifiers, integrators, and offset amplifiers. Figure 3-6 shows some general examples of the use of operational amplifiers.

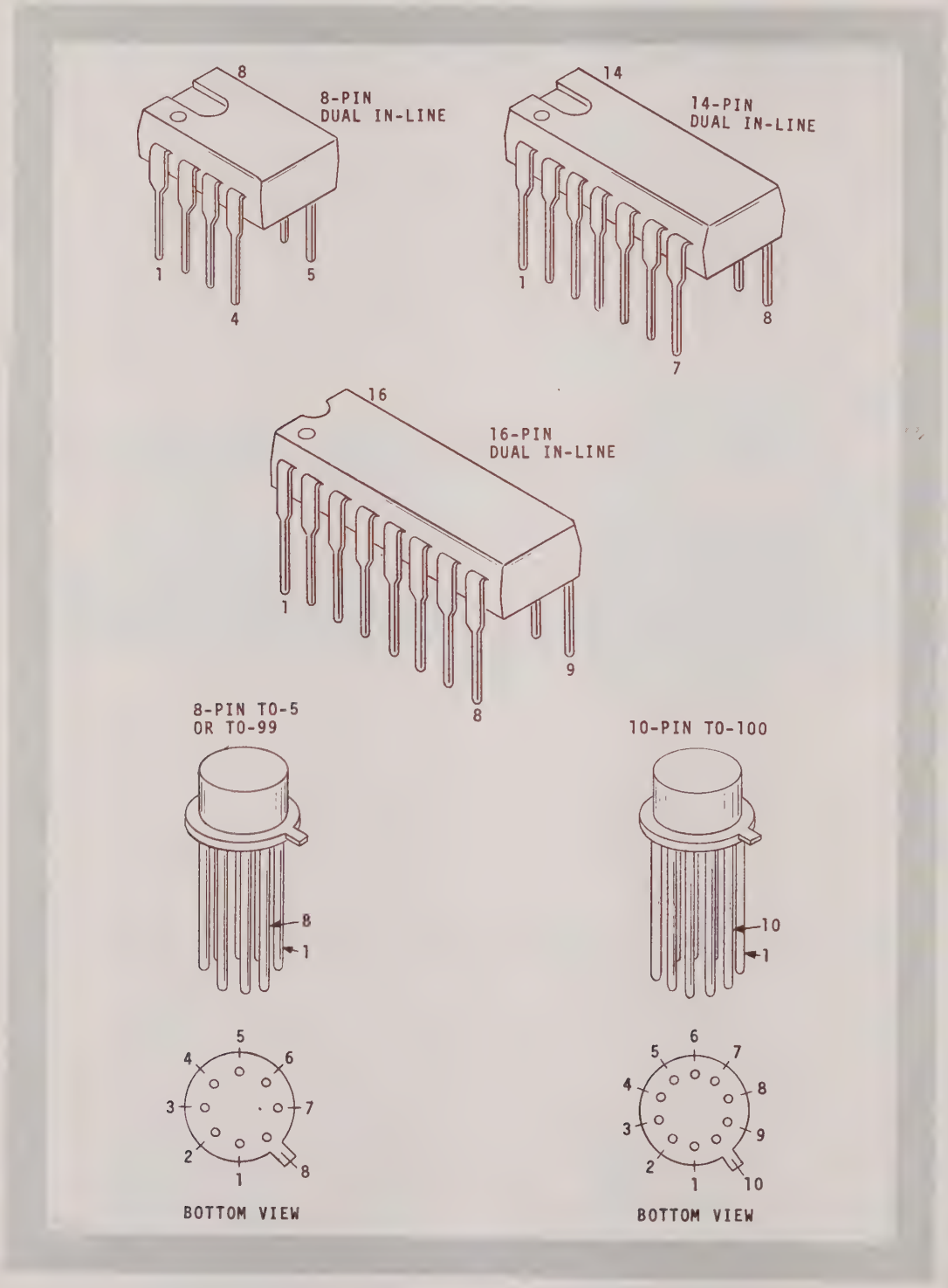


Figure 3-5. Integrated Circuit Chips

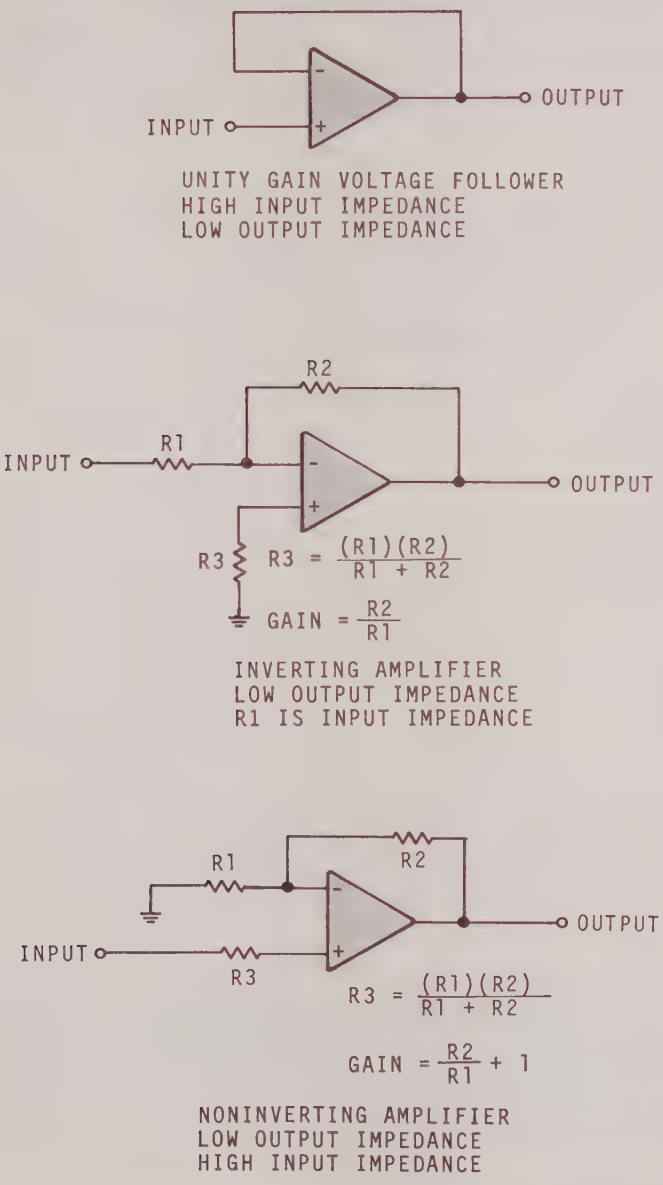


Figure 3-6. Typical Applications of Operational Amplifiers

3-8. FAULT ISOLATION PROCEDURES

Fault isolation procedures for the AILTECH 727 consist of a complete checkout of the instrument under normal operating conditions. Standard laboratory test equipment is utilized throughout the procedures. Reference should be made to Chapter 4 of this manual for location of parts and test points, as well as for schematic diagrams of the instrument. Detailed procedures for fault isolation must be performed in the sequence given except where otherwise specified.

3-9. TEST EQUIPMENT REQUIRED

The test equipment required for troubleshooting the AILTECH is listed in Table 3-2. Equivalent equipment may be used unless otherwise specified.

Table 3-2. Test Equipment Required

Equipment	Identification
100-MHz Comb Generator	AILTECH 707-90
Oscilloscope	Tektronix 502*
Signal Generator	Logimetrics 921A
Signal Generator	Logimetrics 750
Signal Generator	Hewlett-Packard 8616A
Power Meter	Boonton 42A
Frequency Meter	Hewlett-Packard 536A
Frequency Meter	Hewlett-Packard 537
Digital Voltmeter	Systron Donner 7004
Oscilloscope	Tektronix 454

*No equivalent equipment recommended.

3-10. PRELIMINARY PROCEDURES

a. Check that the rear panel LINE VOLTAGE SELECT switch is in the correct position and the correct fuses are in place for the line voltage in use. Connect the AILTECH 727 to 115 or 230 Vac as required.

b. Set the AILTECH 727 controls and switches as follows unless otherwise indicated in text.

Switch	Setting
RF RANGE	1.8-4.0
FULL RANGE	OFF
RF ATTEN	0
IF ATTEN	10
TUNING	3000 MHz
SCAN MODE	AUTO
SCAN WIDTH	100 MHz
SCAN TIME	3 msec
BANDWIDTH (kHz)	AUTO
BANDWIDTH VIDEO	AUTO
AMPLITUDE RANGE	10
POWER	ON (up position)

3-11. AC AND DISPLAY UNIT CHECKOUT

Perform a checkout of the ac input, the power supplies, and the display unit as described in the flow chart of Figure 3-7 and the accompanying instructions. The numbers shown in the upper left corner of the instruction boxes of the flow chart refer to the accompanying instructions which are similarly numbered. Each instruction explains in detail the operations to be performed for that instruction box.

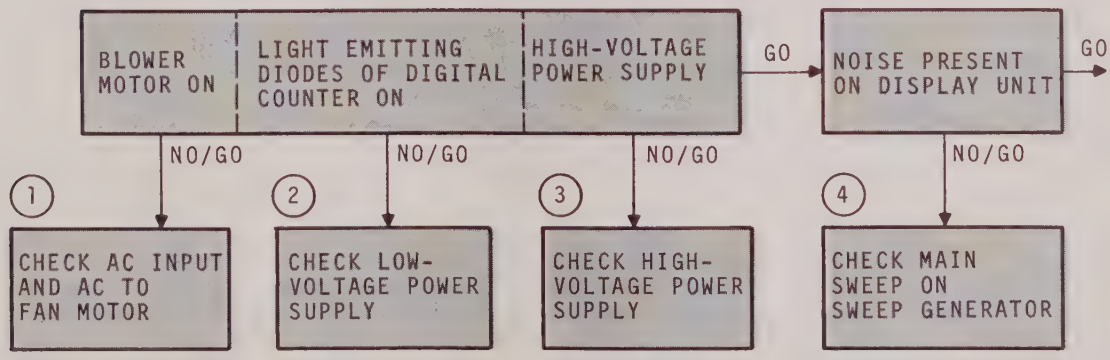


Figure 3-7. Power Supplies and Display Unit Checkout

(1) AC CHECK

At initial turn on, listen for the sound of the blower motor. If it is not on, check the two fuses on rear panel (Figure 4-23) and the ac connection from the power supply distribution board (Figure 4-21) to the fan motor.

(2) LOW VOLTAGE CHECK

Check to see if the light emitting diodes of the digital display are on. If not, check the low-voltage power supply (230426) (Figure 4-21) for the appropriate voltages: +24 Vdc, +18.3 Vdc, -18.3 Vdc, and +5 Vdc.

(3) HIGH VOLTAGE CHECK

WARNING

The display unit high voltage power supply transformer delivers voltages in excess of 7000 volts. Extreme care should be taken when troubleshooting is being done in this area. Servicing should be performed by experienced personnel. If it is determined that the CRT is faulty, care should be taken in the replacement of this part to avoid implosion. Spent CRT's should be carefully wrapped in soft packing material and cushioned from outside shocks before being boxed and discarded.

(4) NO NOISE OR LOW LEVEL NOISE

If noise is not present on the CRT, check that the reference sweepout signal on the J1 sweep generator board (230216) is as shown in Figure 4-16, waveshape (5). If the waveshape is not as shown and there is just a dot in the center of the CRT, +6 V reference is probably at fault. Check that the ±6 V reference on the J4 preamplifier board (230480) (Figure 4-20) is working properly. The dot may also be caused by defective Q7 and Q8 transistors on the J18 YIG driver board (299400) (Figure 4-29). To check these two transistors, reduce the SCAN WIDTH switch setting to 300 kHz. If the noise is now present, this verifies that Q7 and Q8 are shorted and both should be replaced. If, however, the dot is still present, check the horizontal and vertical deflection on the deflection amplifier. If the deflection amplifier is working properly, recheck the low-voltage power supply for a low voltage.

3-12. RF AND IF SECTION CHECKOUT

a. Perform an RF sensitivity check using front panel controls.

1. Set front panel controls of the AILTECH 727 as follows:

Switch	Position
SCAN WIDTH	3 MHz
BANDWIDTH VIDEO	500
BANDWIDTH (kHz)	1000
IF ATTEN	10
RF ATTEN	0
RF RANGE	0.001 to 2.0
TUNING	1000 MHz

2. Set the appropriate signal generator to 1000 MHz. Calibrate the signal generator's variable attenuator with the use of a power meter at -10 dBm.

3. Connect the signal generator to the RF INPUT jack of the AILTECH 727. Reduce the signal level of the generator until the signal is 2 dB above the noise. (It may be necessary to vary the IF ATTEN switch several dB in order to make the reading of the measurement easier.)

4. The 1-MHz per division sensitivity for band 1 should be -90 dBm minimum with an IF Bandwidth of 1 MHz.

5. The sensitivity of the other bands can be determined by repeating the preceding steps for the frequencies and bands listed below:

RF RANGE (GHz)	Tuning and Signal Generators	1 MHz (BW) Sensitivity
1.8 to 4.0	3000 MHz	- 80 dBm min
3.3 to 8.3	5800 MHz	- 75 dBm min
5.4 to 12.4	8900 MHz	- 70 dBm min
10-20	15,000 MHz	- 60 dBm min

6. If sensitivity is as specified above, no further RF and IF section checks are necessary. If, however, sensitivity does not meet these requirements, proceed with the following RF and IF section checkout.

b. Perform a checkout of the RF and IF section as described in the flow chart of Figure 3-8 and the accompanying instructions. The numbers shown at the upper left corner of the instruction boxes of the flow chart refer to the accompanying instructions which are similarly numbered. Each instruction explains in detail the operations to be performed for that instruction box.

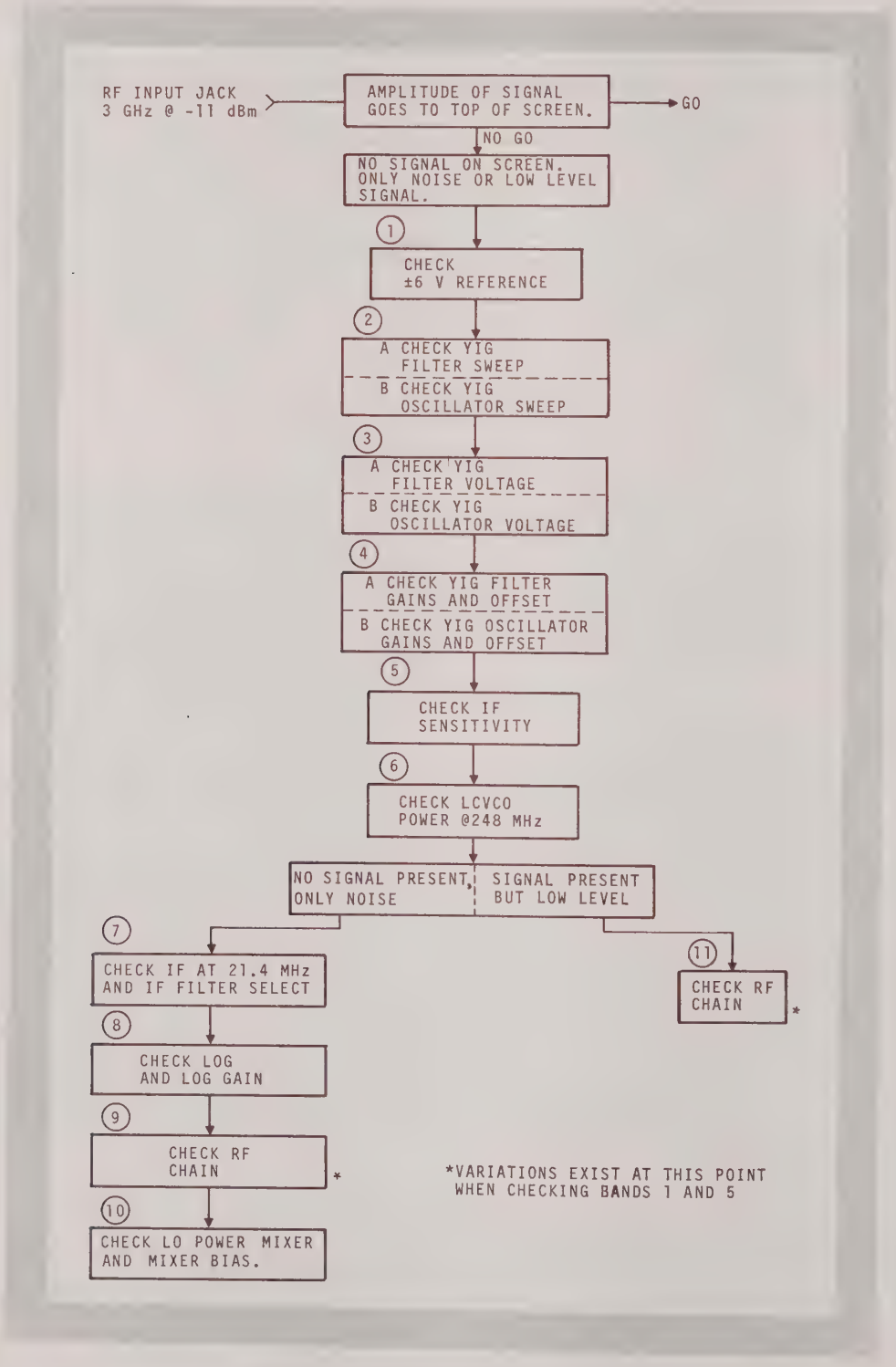


Figure 3-8. RF and IF Section Checkout

(1) ±6 REFERENCE CHECK

The +6 V reference is located on the J4 preamplifier board (230480) (Figure 4-20). The +6 V reference can be conveniently measured at the cathod of CR6 while the -6 V reference can be measured at the anode of CR7. If necessary, adjust the +6 V reference by adjusting R34 to +6.000 ±0.001 Vdc. The -6 V reference can be adjusted by varying R31 such that at final setting it reads -6.000 ±0.001 Vdc.

(2) YIG FILTER SWEEP CHECK

Check the YIG filter signal at pin 5 of the J18 YIG driver (299400) for waveshape 4 of Figure 4-29. If it is not present, check for correct filter gain at pin 4 (waveshape 9 of Figure 4-29). If the input is not correct, check the YIG sweep at pin R of the J1 sweep generator board (230216) for waveshape 6 of Figure 4-16. (This is where the YIG sweep is generated.

(2B) YIG OSCILLATOR SWEEP CHECK

Check the VCO tune signal at pin 15 of the J18 YIG driver (299400) for waveshape 6 of Figure 4-29. If it is not present, check the VCO gain at pin B for waveshape 8 of Figure 4-29. If the input is not correct, check the YIG sweep at pin R of the J1 sweep generator board (230216) for waveshape 6 of Figure 4-16. (This is where the YIG sweep is generated.

(3A) YIG FILTER VOLTAGES CHECK

Check the YIG filter (299463) (Figure 4-24) for +24 Vdc on pin 2 and +24 Vdc return on pin 3. This is the heater control voltage. Pin 1 is the plus filter drive and pin 4 is the minus filter drive.

(3B) YIG OSCILLATOR VOLTAGES CHECK

Check the YIG VCO (230186) (Figure 4-24) for the +18 Vdc on pin 7. In addition, check for the presence of the plus and minus FM tune signals on pins 3 and 4 at 1 MHz/div and VCO drive signal on pins 5 and 6 in 10 MHz/div.

(4A) YIG FILTER OFFSET AND GAIN ADJUSTMENT CHECK

The YIG FILTER OFFSET and GAIN adjustment potentiometers are located on the RF RANGE switch (299302) (Figure 4-5). See Figure 3-11 for adjustment locations. The band 2 (1.8 - 4.0 GHz) FILTER OFFSET potentiometer is R47. The YIG FILTER GAIN potentiometer is R20. Refer to paragraph 3-33 to 3-37 for the final settings of these potentiometers.

(4B) YIG VCO OFFSET ADJUSTMENT CHECK

The YIG VCO OFFSET potentiometers are located on the RF RANGE switch (299302) (Figure 4-5). See Figure 3-11 for adjustment locations. The band 2 (1.8 - 4.0 GHz) VCO OFFSET potentiometer is R32. By varying this potentiometer, the frequency of the VCO can be shifted. Refer to paragraph 3-34 for the adjustment procedure and final setting of this potentiometer.

(5) IF SENSITIVITY CHECK

To check the IF sensitivity, disconnect the 227-MHz band-pass filter and the mixer bias. Inject a 227-MHz at -10 dBm signal into the 227-MHz band-pass filter (299374) (Figure 4-24) see point (D) of the block diagram (Figure 3-14). Adjust the frequency of signal generator for maximum response. The noise level should rise to the top of the screen. Reduce the injected signal until the noise no longer moves when the signal is varied; this should be at approximately -105 dBm when the 1-MHz scan width is selected. Reconnect the 227-MHz band-pass filter and the mixer bias (230500) after completion of this test.

(6) LCVCO ASSEMBLY CHECK

Check the 248-MHz power out of the LCVCO assembly (230543) (Figure 4-32). The power should be between -5 dBm and 0 dBm at the 248 MHz TEST port.

(7) IF AT 21.4 MHz CHECK

The 248-MHz and the 227-MHz signals are mixed in the IF assembly (299350) to generate the 21.4-MHz IF. To check the IF, jump the cables that are connected to the PROCESSOR INPUT and PROCESSOR OUTPUT (Figure 4-25). Use a signal generator to inject 227 MHz into the RF INPUT of the IF mixer (230394) and measure the IF sensitivity by varying the RF attenuator of the signal generator. The sensitivity should be approximately -100 dBm. This will isolate the IF problem. With the PROCESSOR INPUT and PROCESSOR OUTPUT cables reconnected to the IF assembly, inject 21.4 MHz into the IF OUTPUT cable (Figure 4-25) of the IF attenuator (299367) and measure the sensitivity. It should be approximately -100 dBm. Reconnect cables.

(8) IF AND LOG/LOG GAIN CHECK

Verify the operation of the log IF by injecting a 21.4-MHz signal into the 21.4 INPUT connector on the rear panel (Figure 4-23). Measure the sensitivity at this point; it should be approximately -105 dBm. In addition, verify the operation of the log gain circuitry on the J4 preamplifier board (230480) (Figure 4-20). Log output voltage should be within the range of +3.2 to +5.6 Vdc.

(9) and (11) RF CHAIN CHECK

Check the RF chain by signal injection through the chain to fault isolate to any one component using the values found on Figure 3-14.

NOTE

In band 1 (0.001 - 2.0 GHz) the impedance from the RF input to the band 1 mixer with 0 dB on the IF and RF attenuator should be approximately 10 ohms to ground as measured with an ohmmeter. Less than 1 ohm is correct for bands 2 through 5.

The overall gain in band 2 (1.8 - 4.0 GHz) should be approximately 11 ±7 dB. This gain is measured at 3000 MHz with the AILTECH 727 set as follows:

SCAN TIME	100 μsec (signal peaked)
RF ATTEN	0 dB
IF ATTEN	0 dB
SCAN WIDTH	< 3 MHz
BANDWIDTH	1000 kHz

In addition, the band 2 VSA should be 16 dB referenced to band 4 (5.4 - 12.4 GHz). With a power meter connected to the rear panel 21.4 OUTPUT jack, inject a signal into the RF INPUT jack with sufficient power such that the power meter reads 0 dBm. At each measurement the response should be peaked by tuning the AILTECH 727. Table 3-3 shows point-to-point gain at 3 GHz. Table 3-4 shows the correct signal levels through the RF chain.

Table 3-3. Point-to-Point Gain at 3 GHz

Figure 3-14
Test Points

(A)	to	(B)	-2.0 ±0.5
(B)	to	(C)	-10 ±1.5
(C)	to	(D)	-9.5 ±1.0
(D)	to	(D')	-2.5 ±0.5
(D')	to	(E)	+13.0 ±1.0
(E)	to	(G)	-3.0 ±1
(G)	to	(H)	+22.0 ±2
(A)	to	(I)	+11.0 ±7

Table 3-4. Signal Levels

Figure 3-14 Test Point	
A	-11.0 dBm ±7.0 at 3 GHz
B	-13.0 dBm ±7 at 3 GHz
C	-20.0 dBm ±5.5 at 3 GHz
D	-29.5 dBm ±4.5 at 227 MHz
D'	-32.0 dBm ±4 at 227 MHz
E	-19.0 dBm ±3 at 21.4 MHz
G	-22.0 dBm ±2 at 21.4 MHz
H	0 dBm at 21.4 MHz
I	0 dBm at 21.4 MHz

If the unit has the correct overall gain, the sensitivities should be correct. Table 3-5 shows the correct sensitivities at each point in the RF chain.

Table 3-5. Typical RF Sensitivities

Figure 3-14 Test Point	Typical Sensitivity	Frequency
A	-85 dBm	3 GHz
B	-87 dBm	3 GHz
C	-94 dBm	3 GHz
D	-103.5 dBm	227 MHz
D'	-106 dBm	227 MHz
E	-99 dBm	227 MHz
E'	-107 dBm	21.4 MHz
G	-107 dBm	21.4 MHz
I	-100 dBm	21.4 MHz

The oscillator power levels are given on the block diagram (Figure 3-10).

10 LO POWER AND MIXER BIAS

Check that there is sufficient LO power and that the mixer bias is getting sufficient voltage. Refer to the system block diagram (Figure 3-14) for appropriate levels.

NOTE

When checking band 1, follow a similar procedure; however, note that in band 1 there is additional circuitry and no sweep present on the YIG filter.

11 RF CHAIN (See (9) above)

3-13. PHASE-LOCK LOOP CHECKOUT

Perform a checkout of the phase-lock loop as described in the flow chart of Figure 3-9 and the accompanying instructions. The numbers shown at the upper left corner of the instruction boxes of the flow chart refer to the accompanying instructions which are similarly numbered. Each instruction explains in detail the operations to be performed for that instruction box.

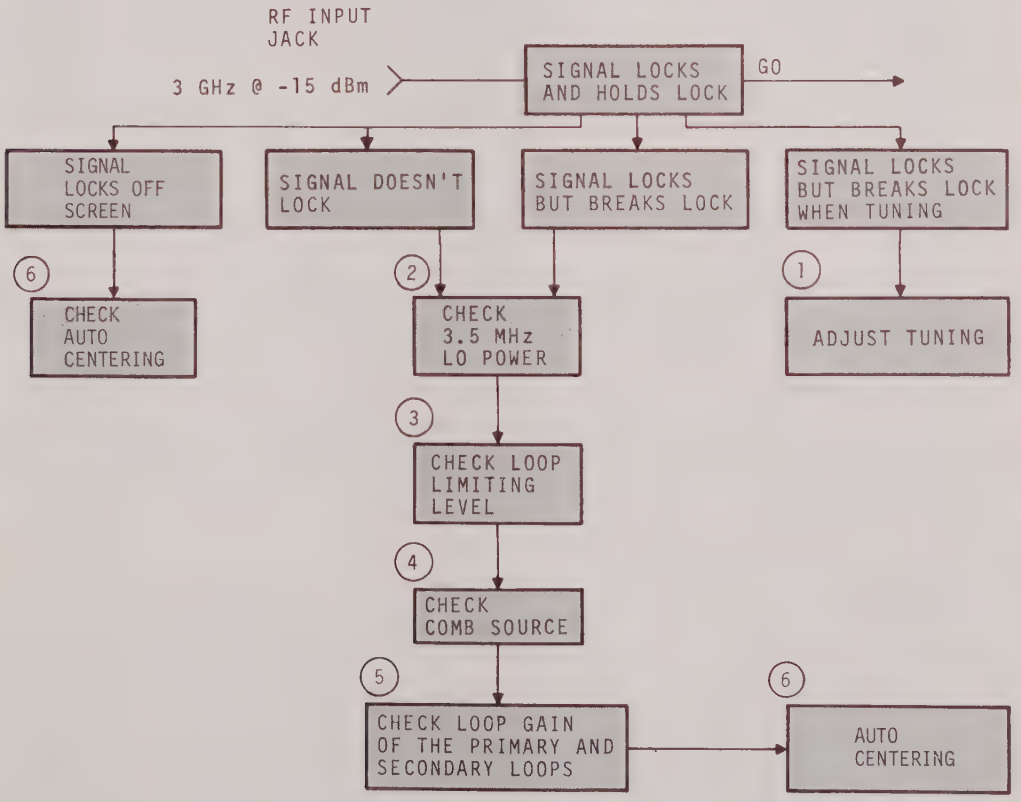


Figure 3-9. Phase-Lock Loop Checkout

(1) SIGNAL BREAKS LOCK ONLY WHEN TUNING

If the signal breaks lock only when tuning, the problem may be that the coarse tuning potentiometer is moving with the fine tuning potentiometer. This can be corrected by verifying that the proper clutch is engaging and the distance between the clutch plates is correct. The distance between the plates can be set by loosening the plate and adjusting the distance for 0.010 inch using a "shim". The tuner assembly (299137) (Figure 4-14) is located directly below the digital display. R1 is the coarse tuning potentiometer and R2 is the fine tuning potentiometer. In scan widths of 700 MHz per division to 1 MHz per division, the coarse tuning potentiometer is activated. In scan widths of 300 kHz or less, the fine tuning potentiometer is activated.

(2) 3.5-MHz LO POWER CHECK

Check to see if the oscillator is operating properly by checking the power output and the frequency of the oscillator. The frequency should be 3.5 MHz at approximately +7 dBm.

(3) LOOP LIMITING LEVEL CHECK

With the SCAN WIDTH switch set to 300 kHz, inject a 3.5 MHz signal into the SIGNAL IN port of the loop assembly (299375) (Figure 4-39). Using another spectrum analyzer and a scope probe on the IF test point (Figure 4-41), beat the external 3.5 MHz signal against the internal 3.5 MHz signal to center the signal generator. Remove the internal 3.5 MHz signal by removing the cable from the 3.5 MHz oscillator to the 3.5 MHz input to the loop. Measure the loop limiting level by finding the 1-dB compression point. This should be approximately -80 dBm. After this test, reconnect the 3.5 MHz oscillator and the SIGNAL IN cable.

(4) COMB SOURCE CHECK

Set the SCAN WIDTH switch to 200 MHz and the RF RANGE switch to band 2 with the frequency set at 3000 MHz. Connect the comb output (from the output of attenuator 230195-3 which is mounted on comb generator 230471-2, Figure 4-24) to the AILTECH 727 RF INPUT jack. Using a clip lead, connect the -18V on the LCVCO assembly (230543) (Figure 4-32) to the -18 V on the comb source. Check the waveform for linearity and ensure that no comb lines are lower than the 70-dB graticule line (RF attenuator 10 dB, IF attenuator 0 dB). After checking for the above, reconnect the cables that were removed and remove the clip lead from the -18 V on the LCVCO assembly and the comb source.

(5) LOOP GAIN CHECK

With the 3.5 MHz oscillator and limiting IF amplifier operating properly, connect a Tektronix 502 oscilloscope using the differential dc input across the 10 ohms sampling resistor R60 located on the J18 YIG driver board (299400) (Figure 4-33). Set R36 on the J18 YIG driver board fully counterclockwise. Set R32 on the J18 YIG driver board fully counterclockwise. Put a 3-GHz S-band signal into the RF INPUT jack of the AILTECH 727. Move it to the center of the screen at the 1 MHz/div dispersion and set the SCAN WIDTH switch to 300 kHz (the phase lock position). It should now be possible to adjust

the SIGNAL CENTER control to skip the displayed signal from line to line on either side of center without depressing the SIGNAL CENTER control. At this point, it should be possible to move the displayed signal only when the SIGNAL CENTER control is depressed; the displayed signal should not move when the SIGNAL CENTER control is undepressed. See paragraph 3-46 for alignment if the unit is not operating properly.

(6) AUTO CENTERING

The auto centering board is operating properly when the signal jumps to the center of screen ±1.5 div when the scan width switch is set to 300 kHz or less. If this does not occur check alignment per paragraph 3-48.

3-14. ADDITIONAL CHECKS

a. Check the full range operation as follows. With the FULL RANGE switch set to ON, verify the operation of the full range marker. If it is not present, or a large dc offset is present, check Z1, Z2, and Z3 and the associated circuitry on the J1 sweep generator board (230216) (Figure 4-16).

b. If the unit is not working properly in the 1 and 3 MHz positions of the SCAN WIDTH switch, check Z1 and S3. Check the J18 YIG driver board (299400) (Figure 4-29) for the appropriate waveforms at test points (1) (2) and (3).

3-15. SYSTEM PERFORMANCE CHECK

This section contains calibration and adjustment procedures for the AILTECH 727 Spectrum Analyzer. The procedures presented in this section will aid the user in determining if the instrument is operating properly and in aligning the instrument for optimal performance.

The procedures should be scheduled on a periodic basis. If a system malfunction is discovered while performing these procedures, refer to paragraph 3-8 for fault isolation procedures.

NOTE

The user should be familiar with the operating procedures presented in the Operating Manual before attempting to calibrate or adjust the instrument.

The following sequence of checks on the AILTECH 727 Spectrum Analyzer are designed to verify the performance of the instrument. All checks are performed using the front panel operating controls.

3-16. INITIAL TURN-ON

Set the POWER switch to the on position and note that the following occurs: (1) the blower motor starts with an audible sound; (2) the MHz digital readout illuminates indicating a number denoting the frequency at the center of the screen. After a short warmup (2 to 10 seconds), the cathode ray tube will illuminate; noise, and possibly signals, should be present.

3-17. INITIAL CONTROL SETTINGS

Set the switches and controls as follows to obtain normal presentation:

SCAN MODE	AUTO (sweep is self-synchronous)
SCAN WIDTH	200 MHz
SCAN WIDTH vernier	CAL (fully clockwise)
SCAN TIME	3 msec
SCAN TIME vernier	CAL (fully clockwise)
BANDWIDTH:	
(kHz)	AUTO (The 1-MHz IF filter for the selected scan width and scan time combination is energized.)
VIDEO	AUTO (The AUTO settings of the VIDEO control links it with the IF filter selection.)
AMPLITUDE RANGE	10 LOG (dB/DIV)
RF ATTEN	10 (The setting of the RF ATTEN switch limits the amount of power incident into the AILTECH 727.)
IF ATTEN	10 (The setting of the IF ATTEN switch normalizes the overall gain of the instrument.)
RF RANGE	0.001 - 2.0
FULL RANGE	OFF
SIGNAL CENTER	Indexing line pointing straight up (centered). (The SIGNAL CENTER control performs very specific functions and is not intended to be used only as a fine tuning control.)

3-18. DISPLAY UNIT ALIGNMENT

To properly align the trace on the screen the HOR POS control and the VERT POS control on the front panel should be adjusted in the following manner:

a. Allow one-half hour for warmup and set the IF ATTEN switch to 100 and the BANDWIDTH switch to 1 kHz.

b. Adjust the horizontal control so that the sweep starts at the left edge of the graticule.

c. Adjust the vertical control to position the trace 1/5 of a division below the 100 dB line. There are two small marks on the graticule which indicate this position which is the 102 dB point.

d. Set the IF ATTEN switch to 10 and the BANDWIDTH switch to AUTO. The noise presentation on the screen will return to approximately the 70 dB line.

3-19. PERFORMANCE CHECK

To acquaint the operators with the proper action of the instrument, the following performance check is explained in terms of what happens when a check is performed on an instrument which is operating normally.

3-20. Video

As the IF ATTEN switch is varied from the 0 position down through its positions, the baseline noise can be seen to vary up to 30 dB. This is a normal occurrence and is a result of inserting attenuation into the IF chain. The source of the displayed noise is the first amplifier with the least attenuation, and this source moves through the amplifier chain until it finally occurs at the log IF with maximum attenuation. The expansion of the baseline on the AMPLITUDE RANGE switch from 10 dB/DIV to 2 dB/DIV is always around the low portion of the display, that is the 100 dB line. If the noise level is above the 100 dB line when an expansion is selected, the noise will rise up to the middle, or even the top of the display. If enough attenuation has been inserted in the IF chain to drop the noise level to the 100 dB line, the noise level will remain there when the expansion is selected. If a small scale signal is selected in the 2 dB/DIV section with the signal at the top of the screen and the LIN (linear) display selected, the signal will be approximately the same amplitude as the 2 dB display and the baseline will be the same.

3-21. Tuning

The TUNING control has several functions. It is a concentric knob with a fine and coarse control mechanically linked together with an approximate 6:1 reduction, thereby achieving good control of tuning at all times. The control actually drives one of two potentiometers located behind the front panel, and they, in turn, control the entire system. The automatic switchover point is set by the SCAN WIDTH switch when it is switched from 1 MHz to 300 kHz. Thus, one of the potentiometers controls the analyzer for its wide dispersion capability, and the other for its narrow dispersion capability. Rotating the control determines the frequency at the center of the screen, and on the display tube the entire spectrum will move from right to left when this is done. The control also determines the frequency on the digital readout which corresponds to the frequency at the center of the screen.

With the settings of the controls as described, there should be a presentation on the screen of a noise baseline approximately 1 division high and centered on the 70 dB line, plus or minus a division. The noise baseline should extend horizontally more than 10 divisions and its position on the screen is controlled by the TUNING control. Rotating the TUNING control until the frequency readout reads 1000 MHz should position the baseline such that it occupies a little more than the full screen. The starting point of the baseline should be on the very edge of the etched graticule, whereas the ending point extends a little beyond the right edge. Possibly visible on the left edge of the presentation at the 0 MHz point is a large signal referred to as "zero beat." If not visible, the analyzer may be tuned to bring it on to the screen, and then tuned to bring it to the center of the screen. By turning the SCAN WIDTH switch step by step down to 10 MHz, while bringing the signal to the center of the screen, it is possible to view it in better detail. As the SCAN WIDTH switch is reduced, the signal should remain at the center of the screen within a division, so that it will be easy to keep it in view. The signal, which is actually the local oscillator feedthrough in the first mixer, is exactly at 0 MHz reference for the analyzer. This is so because the local oscillator is now tuned to the center of the first IF frequency, and the frequency of the signal on the screen is simply the difference between this local oscillator and the IF.

3-22. Digital Frequency Readout

The frequency readout should be reading approximately 0 MHz. When the analyzer is tuned below 0, the counter will read very high numbers, starting up in the 99-GHz region, and this is normal.

Because YIG devices are utilized in the analyzer, there is a hysteresis effect noticeable on the screen when checking for frequency accuracy. This effect is simply caused by tuning a magnetic device either from plus to minus, or minus to plus, and results in a natural offset of the device. On the analyzer, hysteresis is noticed by a frequency inaccuracy, of as much as 10 MHz in fundamental mixing modes (bands 1 and 2). To eliminate this inaccuracy, it is required to sweep the YIG devices from a single direction and with a relatively fast speed. This can be done by simply rotating the SCAN WIDTH switch from the present 10 MHz up to approximately 200 MHz, and then back down to the 10 MHz position. When this is done, a resulting small shift of the signal will probably occur. This operation is popularly referred to as degaussing, and centers the frequency readout and the signal on the screen. It should be repeated every time an accurate frequency readout is desired if the TUNING control has been changed. The "zero beat" indication on the screen should be between 45 and 70 dB above the noise level where the IF ATTEN switch is set to 20 dB. If less signal is present it could indicate that the local oscillator signal is weak, thereby losing some sensitivity for other signals. If much more signal is present it could indicate damage to the first mixer, thereby decreasing the local oscillator to IF isolation characteristics.

3-23. Scan Width Control

Changing the SCAN WIDTH switch from the 10 MHz position to the 3 MHz position causes two effects (when the SCAN TIME switch is set at 3-msec). One, if the IF bandwidth is automatically switched from 1000 kHz to 100 kHz as can be confirmed by rotating the BANDWIDTH switch to these positions. The second effect is an apparent capacitor charge action, in that the signal that had been on the center of the screen will jump a certain amount and then return toward center. At the 3 MHz position, a capacitor is connected to the main oscillator to increase stability for more detailed analysis. As the SCAN WIDTH switch is switched from 3 MHz band to 10 MHz and then down to 3 MHz, it is noticed that the charge action of the capacitor is much decreased since the initial charge has been erased.

3-24. Auto Centering - Auto Phase Lock

The 727 Series Spectrum Analyzers are supplied with an automatic centering and automatic phase locking system. The auto centering auto phase lock consists of an 8 Hz search oscillator which is located in the Loop Assembly (299375) and an Auto Centering PC board (299378) which is mounted to the underside of the Digital Display board (299468). The auto centering board takes the phase lock loop error voltage and processes it through an A/D converter and then through a D/A converter which samples and holds a digital word, adjusts for band gain variations and sums this voltage with the sweep that feeds the LCVCO (230543), which is located on the Sweep Generator Board (230216). It is this offset on the LCVCO sweep input which causes the phase locked signal to center itself on the display. This in turn cancels out any offset that may have been introduced by the main oscillator while trying to acquire one of the reference comb lines.

3-25. Phase-Lock Loop

When the SCAN WIDTH switch is switched from 1 MHz to 300 kHz, a phase-lock loop system is automatically activated to stabilize the main local oscillator in the analyzer. This oscillator, operating in S-band, is referenced to a crystal controlled comb source which permits a stabilized lock every MHz, when the oscillator is operated in its fundamental mode — that is, when the analyzer is displaying between 0 and 4 GHz. When the analyzer is operating in second, third or fifth harmonic, the lock possibilities occur at every 2 MHz, 3 MHz or 5 MHz. When the actual switch activation is accomplished, the signal on the screen will jump to a lock point, which could occur anywhere on the screen. If the phase lock acquisition is not stable, the signal will appear to have some jitter, or will have sidebands caused by the loop seeking a stable lock. This can be confirmed or overriden by rotating the SIGNAL CENTER control a small amount. If the phase lock is strong, the signal on the screen will not move with this rotation of the control. If the signal does move, it should jump to a stable lock position and then remain as the control is turned a small amount further. Depressing the SIGNAL CENTER control deactivates part of the phase lock system and permits the oscillator to be moved to adjacent comb lines of the stabilization circuit. These positions should be 1 MHz either to the right or the left of the signal, and the signal should actually jump to the spot. If it is possible to walk the signal between two stable points, phase lock adjustment might be required. It is possible to have a stabilized presentation at other than 1 MHz combinations, and these are caused by harmonics in one of the loop mixers. These are stable positions but do not have the firm stability of the main lock. Selecting the most stable position, or the one closest to the center of the screen, the signal can be moved to the center by rotating the TUNING control. It is now noticed that the TUNING control sensitivity has changed drastically as the second potentiometer has been energized. This change in resolution permits the tremendous expansion capability of the analyzer from 700 MHz per division down to 1 kHz per division. Since the digital readout is connected to the main tuning control, and the SIGNAL CENTER control, further tuning in the narrow dispersions will not affect the frequency display. The frequency that is displayed is the frequency of the signal that was in the center of the screen when phase lock was activated. An automatic recentering function is included in the analyzer to maintain the fine tuning potentiometer in the middle of its operating range.

3-26. Crystal Filter Response

With the SCAN WIDTH switch set to 300 kHz and the signal centered on the screen, it may be noticed that the filter shape is not the typical smooth curve, but may have an apparent spurious response usually on the left side of the filter shape. This is normal and is characteristic of a very wide crystal filter. The filter provides excellent selectivity, as is noticed by its better than 5:1 shape factor from 60 to 3 dB. The AILTECH 727 Spectrum Analyzer uses Tchebycheff type filters. These filters are used instead of the Gaussian type filter because of the poor shape factors in the Gaussian type filters. The apparent spurious response or ringing may be apparent approximately 60 dB down from the signal and could be eliminated by changing the SCAN TIME switch to a slower sweep.

With the signal centered on the screen and the SCAN TIME switch set at 3 msec, switching to 100 kHz again changes the filter bandwidth and selects the 10 kHz bandwidth. Further switching down to 10 kHz causes the final bandwidth switch to occur down to 1 kHz. It might be necessary to recenter the signal as the scan width is decreased since the signal was probably not exactly in the center at the wider dispersions. When the narrowest dispersion has been selected and the signal centered, the signal will remain in the center as the scan width is increased.

With the SCAN WIDTH switch set at 10 kHz and the IF bandwidth automatically selected as 1 kHz (AUTO position), further ringing will be noticed on the display. This ringing is characterized by extra responses on the right side of the signal and is normal. It is due to the fact that we are now scanning 100 kHz in frequency with a 1 kHz filter every 30 milliseconds and are not dwelling long enough in the filter bandwidth to permit a normal charge and discharge action to occur. To eliminate the ringing, the scan time can be slowed down to 10 ms per division or the 10 kHz IF filter can be selected. But it should be noticed that when this filter is changed to 10 kHz, a large amount of resolution is lost. The auto select function of the IF bandwidth attempts to select the filter with the best resolution capability without losing the amplitude response of the signal. The filters used in the AILTECH 727 Spectrum Analyzer have the characteristic such that they ring before losing amplitude response, thus warning the operator that he has just started to scan too fast. Scanning wider frequencies with the same bandwidth will result in the amplitude loss.

3-27. Amplitude Range

Resetting the SCAN WIDTH switch to 1 kHz, it is noticed that the noise level is up to almost the 50 dB line. At this point it is possible to increase IF attenuation until the peak of the signal is at the 50 dB line and then change the AMPLITUDE RANGE switch to the 5 position, presenting a 50-dB display on the screen only 10 kHz wide. At this point the residual FM of the signal on the screen should be less than 1/5 of one division, or 200 Hz. By selecting the LINE position on the SCAN MODE switch, it is possible to synchronize the sweep to 60 Hz line frequency and remove that component from the residual FM of the displayed signal.

As pointed out previously, the signal on the screen is exactly the zero frequency marker for the analyzer, and if there were other signals present at very low frequencies, they would be visible to the right of the "zero beat." Typically, signals are displayed at less than 50 kHz in frequency to full amplitude, providing the vast range of 50 kHz to 20 GHz in one unit. The signals to the left of zero frequency are spurious signals and should not be analyzed further. This region is an undefined region for the Spectrum Analyzer.

Increasing the IF ATTEN until the signal goes to the 60 dB graticule with 5 dB per division, and switching the AMPLITUDE RANGE switch to 2 dB should once again give a full screen presentation of 20 dB. Switching the control to LIN should give nearly the same presentation, since the linear display is approximately 20 dB, but in this mode 10 dB of IF attenuation should drop the signal approximately 2/3 amplitude. When varying the AMPLITUDE RANGE switch through all of its positions, the average noise of the baseline should stay steady when the narrowest IF bandwidth is being used.

3-28. Time Domain

Returning the SCAN WIDTH switch to 10 MHz and turning the SCAN TIME switch to the position marked 1000 μsec (TIME DOMAIN) (1 msec per division), a time domain presentation should be visible on the screen. Since the signal being displayed is a CW signal, only the characteristic of the amplitude response of the IF filters will be viewed, and when the TUNING control is varied the amplitude will go up and then down the filter shape. When the BANDWIDTH switch is in its AUTO position the 1 MHz bandwidth is selected when the time domain is activated. If a different bandwidth is desired, it may be manually selected. If amplitude modulation had been present it would be possible to view square waves or pulses, and changing the SCAN MODE switch to VIDEO would synchronize the display on the screen. The triggering level is fixed and thus the amplitude of the signal must be varied to control the presentation.

3-29. General Operation

Returning back to 3 msec on the SCAN TIME switch, setting SCAN WIDTH switch to 200 MHz, and tuning the frequency readout to 1000 MHz we can again see the full zero to 2 GHz presentation. Switching the RF RANGE switch to the 1.8 - 4.0 position (band 2) the unit now displays all of S-band. The frequency readout will be reading approximately 3000 MHz since the center of the TUNING control corresponds to the center of the selected RF range and has the same rate of tuning per MHz in all frequency bands. The vertical level of the baseline for the second band will decrease approximately 5 dB from that of the first band, and indicates the improved sensitivity achievable in this band. By tuning the analyzer to all the frequencies, while remaining in band 2, it should be noticed that signals below 1.5 GHz are viewable before the trace is blanked. This is normal and very useful. The trace is blanked both above and below the frequency ranges selected on the RF RANGE switch to prevent false interpretation of the noise level as being lack of signal. At these points the local oscillator has either lost power or stopped oscillating and thus the analyzer could not display proper signals. The blanking may be overridden by an internal control if the user so desires to permit the fullest operation, although this could potentially cause some readout discrepancies.

Returning the digital readout to 3000 MHz and selecting band 3 (3.3 - 8.3 position on the RF RANGE switch), the baseline should shift approximately 8 dB upward indicating the loss in sensitivity due to second harmonic mixing. The baseline shifting is caused by gain compensation in the analyzer to provide amplitude calibration over the whole frequency range. In this band the SCAN WIDTH switch should be set at 500 MHz to display the whole frequency range. The center of the frequency will be 5800 MHz. Switching of the RF RANGE switch to band 4 (5.4 - 12.4 position) and the SCAN WIDTH switch to the 700 MHz position selectes this whole band frequency with the center frequency at 8900 MHz. The baseline again shifts approximately 8 dB and should now be at about the 60 dB line.

3-30. Blanking and Full Range Select

Switching the RF RANGE switch down to band 2 (1.8 - 4.0 position), which had been viewed earlier, should now greatly decrease the horizontal display on the screen since the SCAN WIDTH switch is in the 700 MHz position. The regions outside of the baseline have been blanked since the oscillator cannot perform over this great area. Changing the SCAN WIDTH switch to 200 MHz restores the full sweep presentation. At this point if the FULL RANGE switch concentric to the RF RANGE switch is turned to the ON position, the same 2 to 4 GHz presentation will occur, but with negative marker at the center of the screen. This marker indicates the location of the TUNING control and will follow it as it is changed. The digital readout also indicates the frequency of the marker and permits signals to be identified anywhere within the band. By rotating the FULL RANGE switch to the OFF position, the area around the tuning marker will be expanded to the width selected at the SCAN WIDTH switch. This function is not a truly precise one and the center frequency will be within 30 MHz of that desired.

3-31. Refer to DISPLAY Section of the manual for information on the Display Unit.

3-32. PERIODIC MAINTENANCE

This section contains system checks and alignments to be performed every six months or 1000 hours of use, whichever occurs first, or whenever a major repair or replacement has been performed.

3-33. POWER SUPPLY AND REGULATOR ADJUSTMENT

a. Using a digital voltmeter, check the output voltages of power supply (230426). These voltages should be +18.3, -18.3, +24, and +5 Vdc and are adjustable by their respective pots on the power supply.

b. Connect a digital voltmeter between the anode of CR7 on the preamplifier J4 board (230480) and chassis ground. Adjust R31 on preamplifier board (230480) (Figure 3-11) for a -6 ±0.005 Vdc reading.

c. Connect a digital voltmeter between the cathode of CR6 on the preamplifier J4 board (230480) and chassis ground. Adjust R34 on the preamplifier J4 board (230480) (Figure 3-11) for a +6 ±0.005 Vdc reading.

3-34. BAND 1 ALIGNMENT

a. Connect an AILTECH 707-90 Comb Generator or equivalent to the RF INPUT jack of the AILTECH 727.

b. Set the front panel switches and controls to the following positions:

RF RANGE	0.001 - 2.0
RF ATTEN	20
IF ATTEN	10
SCAN WIDTH	200 MHz
BANDWIDTH	
(kHz)	AUTO
VIDEO	AUTO
AMPLITUDE RANGE	10 LOG (dB/DIV)
SCAN MODE	AUTO
BASELINE (outer knob)	Maximum counterclockwise
CONTRAST (inner knob)	Maximum counterclockwise
FULL RANGE (RF RANGE center knob)	OFF
SIGNAL CENTER	Centered
TUNING	Center (digital readout should read 1000 MHz)

c. Twenty comb lines should appear on screen. If not, adjust R50 (Figure 3-11) (band 1 filter offset) on YIG offset board (part of RF RANGE switch 299302) until 20 comb lines appear. Two settings are sometimes possible: the most clockwise setting is correct.

d. Adjust horizontal control on front panel until trace begins on first graticule line (overlap on right side is normal).

e. Set SCAN WIDTH switch to 100 MHz. Adjust R24 (display gain) on sweep generator J1 board (230216) (Figure 3-12) so that each 100-MHz comb line falls on a graticule line. (Some adjustment of TUNING control will be necessary to cause first comb line to fall on first graticule line.)

f. Disconnect AILTECH 707-90 Comb Generator. Adjust TUNING control to approximately 0 MHz until band 1 zero beat frequency signal (refer to paragraph 3-21) is in center of screen. Set SCAN WIDTH switch to 10 MHz and recenter. Set SCAN WIDTH switch to 200 MHz; zero beat should stay in center of screen. If not, adjust R22 (level shift adjust) on sweep generator J1 board (230216) (Figure 3-12).

NOTE

Adjust R22 only when the SCAN WIDTH switch is in the 200 MHz position.

Turn TUNING control to center zero beat when at 10 MHz per division. Repeat procedure until signal remains centered when SCAN WIDTH switch is rotated.

g. Adjust R18 (balance) on preamplifier J4 board (230480) (Figure 3-10) until there is no baseline movement when the AMPLITUDE RANGE switch is rotated between the 2, 5, and 10 positions with the IF ATTEN switch set to 100 dB. Return the IF ATTEN switch to 10 dB after alignment.

h. Adjust R32 (log gain) on preamplifier J4 board (230480) (Figure 3-10) until it is approximately five turns from maximum counterclockwise position. This should position R32 such that the display is properly calibrated, that is, the display varies linearly with the setting of the IF ATTEN switch. It may be necessary to vary R32 slightly clockwise to achieve this. Some interaction with the VERT control will be noted. Repeat paragraph 3-18 before continuing.

i. Turn TUNING control to center of band (1000 MHz) and connect the comb source (AILTECH 707-90 Comb Generator). Ground test point on digital display (299468) with a clip lead (Figure 3-13). The digital readout should indicate 1000 MHz. If not, adjust R69 (band 1 slope) (Figure 3-11) on digital display gain board (231028) (part of RF RANGE switch 299302) for the proper reading.

j. Locate 1000-MHz comb line by counting 10 lines up from the zero beat line. (Zero beat line does not change amplitude when RF ATTEN switch is rotated.) The 1000-MHz line should fall in center of screen. If not, adjust R35 (band 1 VCO offset) (Figure 3-11) on YIG offset board (230339) (part of RF RANGE switch 299302). Adjust R50 (Figure 3-11) on YIG offset board (230339) (part of RF RANGE switch 299302) for maximum amplitude.

k. Remove clip lead from test point on J3 board and set zero beat signal to center of screen at 10 MHz per division. Adjust R58 (band 1 gain) (Figure 3-11) on digital display gain board 231028 (part of RF RANGE switch 299302) until digital readout indicates 0 MHz. Set SCAN WIDTH switch to 200 MHz, RF ATTEN switch to 20 and TUNING control to 1000 MHz. Adjust R1 (band 1 mixer bias) on bias interface J2 board (299344) (Figure 3-12) until all signals are maximized.

l. It should be noted that in the 0.001 - 2.0 GHz band the YIG preselector (299463) is fixed tuned at 2.287 GHz and a 2-GHz low-pass filter acts as the preselector for this band. Therefore it may be necessary to increase the RF input attenuator in order to avoid overload of the mixer.

m. It will be necessary to set the video offset potentiometer R49 of the preamplifier J4 board 230480 (see Figure 3-10). Adjust R49 for a dc offset of 0 volts at the rear panel "VIDEO OUT" connector. This can be measured with any standard oscilloscope.

3-35. BAND 2 ALIGNMENT

a. Set RF RANGE switch to 1.8 - 4.0 GHz, SCAN WIDTH switch to 200 MHz, and TUNING control to 3000 MHz (as read on digital readout).

b. Adjust R32 and R47 (Figure 3-11) on YIG offset board (230339) and R20 (Figure 3-11) on YIG gains board (299304) until 20 scan lines appear on the screen. (Both boards are part of RF RANGE switch 299302.)

NOTE

There are two responses: one with the YIG VCO on low side of filter (incorrect) and one with the YIG VCO on high side of filter (correct). Clockwise turning of all offset pots increases frequency, therefore, the most clockwise response of R32 to VCO offset and the most counterclockwise response of R47 YIG filter offset is correct.

c. Ground test point on digital display board J3 (299468) with clip lead (Figure 3-13). Digital readout should indicate 3000 MHz; if not, adjust R66 (Figure 3-11) on digital display gain board (231028) (part of RF RANGE switch 299302).

d. Locate 3000-MHz line (center frequency, band 2) with signal generator or frequency meter. Adjust R32 and R47 (Figure 3-11) on YIG offset board (230339) (part of RF RANGE switch 299302) to move this line to center of screen as SCAN WIDTH switch is decreased to 10 MHz.

e. At 200 MHz per division, adjust R20 (Figure 3-11) on YIG gain board (299304) until tracking occurs on first and last graticule lines. Adjust R47 and R20 (Figure 3-11) for best tracking. These controls are optimized when best response occurs with SIGNAL CENTER control at the center of its range.

f. Remove clip lead from test point on J3 board and ensure that 3000 MHz is still on center of screen; adjust TUNING control if not. Then, with SCAN WIDTH switch at 30 MHz, rotate TUNING control slowly counterclockwise and count 100 MHz comb lines until the 2000-MHz line (band 2 lower calibration point) is identified. Center this line at 10 MHz per division and adjust R56 (Figure 3-11) on digital display gain board (231028) until digital readout indicates 2000 MHz. Check 2000-MHz comb line with a frequency meter or signal generator.

g. Adjust R2 (Figure 3-12) on bias interface J2 board (299344) until all signals are maximized.

3-36. BAND 3 ALIGNMENT

a. Set RF RANGE switch to 3.3 - 8.3 GHz, SCAN WIDTH switch to 200 MHz, TUNING control to 5800 MHz (as read on digital readout), and RF ATTEN switch to 0.

b. Adjust R29 and R44 (Figure 3-11) on YIG offset board (230339) and R17 on YIG gains board (299304) until 20 scan lines appear on screen. There are two responses: one with the YIG VCO on the low side of the filter (incorrect) and one with the YIG VCO on the high side of the filter (correct). Clockwise turning of all offset pots increases frequency, therefore, the most clockwise response of R29 and the most counterclockwise response of R44 is correct.

c. Ground test point on digital display board J3 (299468) with clip lead (Figure 3-13). Digital readout should indicate 5800 MHz, if not, adjust R63 (Figure 3-11) on digital display gain board (230335).

d. Locate 5800-MHz line (center frequency, band 3) with signal generator or frequency meter. Adjust R29 and R44 (Figure 3-11) on YIG offset board (230339) to move this line to center of screen as SCAN WIDTH switch is decreased to 10 MHz.

e. Set SCAN WIDTH switch to 500 MHz and adjust R17 (Figure 3-11) on YIG gains board (299304) until tracking occurs on first and last graticule lines. Adjust R44 and R17 for best tracking. These controls are optimized when best response occurs with SIGNAL CENTER control at the center of its range.

f. Remove clip lead from test point on J3 board and ensure that 5800 MHz is still on center of screen; adjust TUNING control if not. Then, with SCAN WIDTH switch at 30 MHz, rotate TUNING control slowly counterclockwise and count 100 MHz comb lines until the 4800 MHz line (band 3 lower calibration point) is identified. Center this line at 10 MHz per division and adjust R54 (Figure 3-11) on digital display gain board (231028) until digital readout indicates 4800 MHz. Set SCAN WIDTH switch to 200 MHz and RF ATTEN switch to 20.

g. Adjust R3 (Figure 3-12) on bias interface J2 board (299344) until all signals are maximized.

3-37. BAND 4 ALIGNMENT

a. Set RF RANGE switch to 5.4 - 12.4 GHz, SCAN WIDTH to 200 MHz, TUNING control to 8900 MHz (as read on digital readout), and RF ATTEN switch to 0.

b. Adjust R26 and R41 (Figure 3-11) on YIG offset board (230339) and R14 on YIG gains board (299304) until 20 scan lines appear on screen. There are two responses: one with the YIG VCO on the low side of the filter (incorrect) and one with the YIG VCO on the high side of the filter (correct). Clockwise turning of all offset pots increases frequency, therefore, the most clockwise response of R26 and the most counterclockwise response of R41 is correct.

c. Ground test point on digital display board J3 (299468) with clip lead (Figure 3-13). Digital readout should indicate 8900 MHz, if not, adjust R60 (Figure 3-11) on digital display gain board (231028).

d. Locate 8900-MHz line (center frequency, band 4) with signal generator or frequency meter. Adjust R26 and R41 (Figure 3-11) on YIG offset board (230339) to move this line to center of screen as SCAN WIDTH switch is decreased to 10 MHz.

e. Set SCAN WIDTH switch to 700 MHz and adjust R14 on YIG gains board (299304) untii tracking occurs on first and last graticule lines. Rotate SIGNAL CENTER control to obtain maximum signal amplitude of comb lines at 10 MHz per division and 200 MHz per division positions. Adjust R41 and R14 (Figure 3-11) for best tracking. These controls are optimized when best response occurs with SIGNAL CENTER control at the center of its range.

f. Remove clip lead from test point on J3 board and ensure that 8900 MHz is still on center of screen; adjust TUNING control if not. Then, with SCAN WIDTH switch at 30 MHz, rotate TUNING control slowly counterclockwise and count 100 MHz comb lines until the 7900-MHz line (band 4 lower calibration point) is identified. Center this line at 10 MHz per division and adjust R52 (Figure 3-11) on digital display gain board (231028) until digital readout indicates 7900 MHz. Set SCAN WIDTH switch to 200 MHz and RF ATTEN switch to 20.

g. Adjust R4 on bias interface J2 board (299334) until all signals are maximized.

3-38. BAND 5 ALIGNMENT

a. Set RF RANGE switch to 10 - 20 GHz, SCAN WIDTH switch to 700 MHz, TUNING control to 15,000 MHz (as read on digital readout), and RF ATTEN switch to 0.

b. Adjust R23 and R38 (Figure 3-11) on YIG offset board (230339) and R89 on YIG gain board (299304) until 20 scan lines appear on screen. There are two responses: one with the YIG VCO on the low side of the filter (incorrect) and one with the YIG VCO on the high side of the filter (correct). Clockwise turning of all offset pots increases frequency, therefore, the most clockwise response of R23 is correct, and the most counterclockwise response of R38 is correct.

c. Ground the test point on digital display board J3 (299468) with clip lead (Figure 3-12). Digital readout should indicate 15,000 MHz, if not, adjust R10 (Figure 3-11) on digital display gains board (231028).

d. Locate 15,000 MHz line (center frequency band 5) with signal generator or frequency meter. Adjust R23 and R38 on YIG offset board (230339) to move this line to center of screen as SCAN WIDTH switch is decreased to 10 MHz.

e. Set SCAN WIDTH switch to 700 MHz and adjust R89 on YIG gains board (299304) until tracking occurs on first and last graticule lines. Rotate SIGNAL CENTER control to obtain maximum signal amplitude of comb lines at 10 MHz per division and 200 MHz per division positions. Adjust R23 and R89 (Figure 3-11) for best tracking. These controls are optimized when best response occurs with SIGNAL CENTER control at the center of its range.

f. Remove clip lead from test point on J3 board and ensure that 15,000 MHz is still on center of screen; if not, adjust TUNING control. Then, with SCAN WIDTH switch at 30 MHz, rotate TUNING control slowly counterclockwise and count 100 MHz comb lines until the 13,000 MHz line (band 5 lower calibration point) is identified. Center this line at 10 MHz per division and adjust R72 (Figure 3-11) on digital display gain board (231028) until digital readout indicates 13,000 MHz. Set SCAN WIDTH switch to 200 MHz.

g. Adjust R5 on bias interface J2 board (299344) and R48 on YIG driver board until all signals are maximized.

h. Switch the FULL RANGE switch to the ON position. It will appear that the tracking has changed by rolling off at the high and low ends. To correct this adjust R51 on YIG driver board for optimum tracking for band 5 only.

3-39. END BAND LIMITS ADJUSTMENT

a. Set the front panel switches and controls to the following settings:

RF RANGE	3.3 - 8.3
RF ATTEN	0
IF ATTEN	10
SCAN WIDTH	200 MHz
BANDWIDTH	
(kHz)	AUTO
VIDEO	AUTO
AMPLITUDE RANGE	10 LOG (dB/DIV)
SCAN MODE	AUTO
BASELINE (outer knob)	Maximum counterclockwise
CONTRAST (inner knob)	Maximum counterclockwise
FULL RANGE (RF RANGE center knob)	OFF
SIGNAL CENTER	Centered
TUNING	Digital readout should read 3300 MHz

b. Adjust R61 (Figure 3-12) on sweep generator J1 board (230216) to blank all signals below 3300 MHz.

c. Set the TUNING control for a digital readout of 8300 MHz. Adjust R60 (Figure 3-12) on sweep generator J1 board (230216) to blank all signals above 8300 MHz.

d. Verify that the 10-GHz and 20-GHz signals are present in band 5. Adjust R61 if the 10-GHz signal is missing and R60 if the 20-GHz signal is missing.

3-40. FULL RANGE MARKER ALIGNMENT

a. Set the front panel switches and controls to the following settings:

RF RANGE	1.8 - 4.0
RF ATTEN	0
IF ATTEN	10
SCAN WIDTH	200 MHz

BANDWIDTH	
(kHz)	AUTO
VIDEO	AUTO
AMPLITUDE RANGE	10 LOG (dB/DIV)
SCAN MODE	AUTO
BASELINE (outer knob)	Maximum counterclockwise
CONTRAST (inner knob)	Maximum counterclockwise
FULL RANGE (RF RANGE center knob)	ON
SIGNAL CENTER	Centered
TUNING	Digital readout should read 3000 MHz

b. Marker should be sitting in center of 3000 MHz line. Turn TUNING control so that the digital readout indicates 3600 MHz. Adjust R55 (Figure 3-12) on sweep generator J1 board (230216) so that the marker sits in the center of the 3600-MHz comb line. Turn FULL RANGE switch to the OFF position.

3-41. LINEARITY ADJUSTMENT

a. Set the front panel switches and controls to the following settings:

RF RANGE	1.8 - 4.0
RF ATTEN	0
IF ATTEN	As required
SCAN WIDTH	10 MHz
BANDWIDTH	
(kHz)	AUTO
VIDEO	AUTO
AMPLITUDE RANGE	2 LOG (dB/DIV)
SCAN MODE	AUTO
BASELINE (outer knob)	Maximum counterclockwise
CONTRAST (inner knob)	Maximum counterclockwise
FULL RANGE (RF RANGE center knob)	OFF
SIGNAL CENTER	Centered
TUNING	Digital readout should read 3000 MHz

b. Set IF ATTEN switch so that the amplitude of the 3000-MHz comb line covers the full screen. Turn AMPLITUDE RANGE switch to the LIN position. Adjust R46, R37, and R38 on preamplifier board (230480) (Figure 3-10) so that the absolute amplitude of the signal and baseline is the same in LIN as in the 2 dB/div position and that an increase of 10 dB in IF attenuation in the LIN position will cause the signal to drop to the 68 dB graticule on the CRT of the AILTECH 727.

3-42. CATHODE-RAY TUBE ALIGNMENT

Refer to applicable manual for cathode-ray tube alignment procedure.

3-43. SWEEP TIME VERIFICATION

a. Connect a Tektronix 535 or equivalent oscilloscope to SWEEP OUT jack on the rear panel. Set SCAN MODE switch to AUTO, SCAN WIDTH switch to 10 MHz, SCAN TIME switch to 10 μsec, and RF RANGE switch to 0.001 - 2.0. Measure the scan time for the following SCAN TIME switch positions.

SCAN TIME	Min	Max
10 μsec	90 μsec	110 μsec
100 μsec	900 μsec	1100 μsec
1000 μsec	9 msec	11 msec
3 msec	27 msec	33 msec
10 msec	90 msec	110 msec

b. Set the TUNING control for 1000 MHz center screen and the SCAN TIME switch to 3 msec. Turn the SCAN TIME switch to 1000 μsec (TIME DOMAIN). The baseline level should rise indicating that the AILTECH 727 is tuned to one of the 100-MHz comb signals.

3-44. SCAN MODE AND REAR PANEL CHECK

a. Turn the SCAN MODE switch through its range and verify that it is working properly.

b. Set the following switches on the front panel to the positions indicated:

SCAN WIDTH	10 MHz
BANDWIDTH (kHz)	AUTO
IF ATTEN	10
RF ATTEN	0
RF RANGE	1.8 - 4.0
SCAN MODE	EXT TRIG

c. Connect the amplitude calibration output of the Tektronix 535 oscilloscope, set at 1 V/cm, to the EXT TRIG input on the rear panel of the AILTECH 727. The comb lines should be present on the screen of the AILTECH 727.

d. Move the cable from the EXT TRIG connector to the EXT SWEEP connector. Set the SCAN WIDTH switch to 30 MHz and the SCAN MODE switch to EXT SWEEP. Two lines should be present on the AILTECH 727.

e. Move the cable from the EXT SWEEP connector to the EXT BLANK connector on the rear panel of the AILTECH 727 and set the SCAN MODE switch to the AUTO position. The display on the AILTECH 727 should be three blanked signals.

f. Turn the oscilloscope amplitude calibration off and place the cable from the vertical input of the oscilloscope to the BLANK OUTPUT connector on the rear panel of the AILTECH 727. A pulse of approximately 3 volts in amplitude should be present.

g. Connect the VIDEO OUTPUT connector on the rear panel of the AILTECH 727 to the oscilloscope. With the SCAN MODE switch in the AUTO position, a signal should be present on the oscilloscope. Moving the SCAN MODE switch to VIDEO should remove the signal.

3-45. FILTER RESPONSE VERIFICATION

a. Check to see that the IF BANDWIDTH (kHz) AUTO select is choosing the proper filters. The proper filters are as follows: (scan time = 3 ms per division).

Scan Width	Filter Chosen
700 through 10 MHz	1 MHz
3 MHz through 300 kHz	100 kHz
100 through 30 kHz	10 kHz
10 through 1 kHz	1 kHz

b. Set the front panel switches and controls as follows:

RF RANGE	1.8 - 4.0
RF ATTEN	0
IF ATTEN	0
SCAN TIME	3 msec
BANDWIDTH	1000
AMPLITUDE RANGE	10 LOG (dB/DIV)
SCAN WIDTH	1 MHz
SCAN MODE	AUTO
SIGNAL CENTER	Centered
FULL RANGE	OFF

Using an AILTECH 707-90 Comb Generator as an input signal, verify the waveshape of the 1000-kHz filter. If the waveshape is irregular, it can be tuned by varying the two sets of 1-MHz filters in the IF assembly 299350 until a smooth waveshape is obtained.

c. Verify the gain of all four filters in the following manner. Set the SCAN WIDTH switch to 1 kHz while maintaining a signal centered on the screen. Set the BANDWIDTH switch to 1000 kHz. Vary the IF ATTEN switch for a convenient reference, then change the BANDWIDTH switch setting to 100 kHz. Verify that the gain is the same as the 1000-kHz filter ±1 dB. If not, vary the 100-kHz FILTER GAIN adjustment R17, until the filter gains are of equal amplitude. Repeat the procedure for each of the filters by varying the appropriate FILTER GAIN adjustment as required.

d. The voltage switched attenuators (VSA) control the absolute video gain between bands. They are set as follows. Set the SCAN WIDTH switch to 10 MHz and the RF RANGE switch to 5.4 - 12.4 GHz (band 4). Set the TUNING control so that the digital display reads 11000 MHz. Vary the IF ATTEN switch so that a convenient reference can be set on the display. Switch the RF RANGE switch to the 10 - 20 GHz range (band 5). Set the TUNING control so that the digital display reads 11000 MHz. The amplitude should be the same as in band 4, plus or minus 5 dB. If necessary, vary R41, the band 5 gain adjustment, until the signals are well within the stated tolerance. Repeat the procedure for each band using a signal that can be realized in both bands.

NOTE

Make sure that the YIG filter is tracking properly about the signals being used by peaking the signal. This is done by varying the SIGNAL CENTER control for maximum amplitude of the signal.

3-46. LCVCO ALIGNMENT

CAUTION

Do not perform this alignment if the LCVCO is working properly. This alignment is very critical, requires special equipment, and should not be attempted unless the LCVCO is known to be out of alignment or a malfunction of the LCVCO has occurred and a repair has been made.

a. Set the front panel switches and controls to the following positions:

RF RANGE	1.8 - 4.0
RF ATTEN	0
IF ATTEN	0
SCAN TIME	3 msec
BANDWIDTH (kHz)	10
AMPLITUDE RANGE	10 LOG (dB/DIV)
SCAN WIDTH	1 MHz
SCAN MODE	AUTO
SIGNAL CENTER	Centered
FULL RANGE	OFF

b. Open RF deck for access to the LCVCO assembly (230543). Set R18 (SLOPE) and R17 (POSITION) on LCVCO shaper (230595) (part of LCVCO assembly 230543) to fully counterclockwise.

c. Set SCAN WIDTH switch to 300 kHz and set R22 (GAIN) on LCVCO shaper fully counterclockwise. Disconnect the cable to the 227 MHz filter (299376) input and apply 1-MHz comb lines by connecting a cable from an HP-8406 comb generator. Use the 20 - 200 MHz output. Observe the lines on the AILTECH 727 screen. Adjust C2 (MAIN TUNING) on LCVCO oscillator II (230532) (part of LCVCO assembly 230543) to center lines about the 227-MHz filter response. Adjust C1 (FEEDBACK) and C4 (OUTPUT TUNING) on LCVCO oscillator II (230532) for best linearity (even spacing of comb lines). It may be necessary to readjust C2 (MAIN TUNING). Usually the spacing of the right side of the display will be expanded.

d. Adjust R22 (GAIN) so as to line up comb lines on as many graticule markers as possible. A minimum of six lines is required. Use R17 (POSITION)/SLOPE and R18 (SLOPE) for best linearity. These will reduce the expanded right side.

e. Identify the 227-MHz line by selecting 10-MHz comb lines (third line right of the 230-MHz line). Select 1-MHz comb lines again. Increase R22 (GAIN) so that the line spacing is approximately 3.3 divisions. Put the 227-MHz line to center by adjusting C2 (MAIN TUNING). Adjust TUNING control and R22 (GAIN) to obtain exactly four 1-MHz lines for 10 divisions with the SCAN WIDTH switch set to 300 kHz.

f. Reset TUNING control to center and check to make sure that 227-MHz line is still at center. With SCAN WIDTH switch set to 1 MHz, measure the power at 248-MHz test port on the LCVCO assembly; it should be between -5 dBm and 0 dBm.

3-47. PHASE-LOCK ALIGNMENT

Assuming the existence of a working 3.5 MHz limiting IF amplifier, a working comb generator and associated mixers, piping, and hardware in proper order, phase lock is aligned as follows:

a. Connect a Tektronix 502 oscilloscope using the differential dc input across the 10-ohm sampling resistor R60 located on the J18 YIG driver board (299400).

b. Set R36 on the J18 YIG driver board fully counterclockwise.

c. Set R32 on the J18 YIG driver board fully counterclockwise.

d. Put a 3-GHz S-band signal into the RF INPUT jack on the AILTECH 727. Ground 8 Hz oscillator terminal on loop casting.

e. Disconnect J-3 connector from Digital Display board.

f. Change Scan Width to 1 MHz/div. Tune a signal to the center of the screen. Using the oscilloscope measure the voltage across the 10 resistor. We will call this voltage "X". Place this value into the following equation:

$$\left(\frac{X}{10}\right) 1.75 = Y \text{ mV}$$

Y is the value to be used for setting the primary loop gain for this analyzer.

g. Adjust R32 CW while moving the signal on the display from left to right with signal center pot, so that a voltage displacement on either side of zero is "Y" mV as seen on the 502 oscilloscope, that is ± "Y" mV. It should now be possible to adjust the signal center control to "skip" the displayed signal from line to line either side of center without depressing the signal center pot switch. Now adjust R36 slowly in a CW direction until the signal cannot be moved when the signal center pot is turned to either extreme in the undepressed mode. The voltage displacement as seen on the 502 oscilloscope in the depressed mode should be ±40 mV.

h. Turn unit off and reconnect the digital display board. Turn unit on and set the scan width to 100 MHz/div.

3-48. Auto Centering

a. Set the RF Range Switch (S3) to Band 4 with 8000 MHz in the center of the screen.

b. Set the scan width to 100 MHz/div. Monitor TP1 on the AUTO Centering board using a Digital Voltmeter.

c. Adjust R9 on the Auto Centering until the voltmeter reads 0V ±10 mV.

d. Set the Scan Width to 1 MHz/div and center a signal on the screen of the analyzer.

e. Change the Scan Width to 300 kHz/div. The signal should snap close to the center of the screen. If it doesn't vary R15 on the Auto Centering board until the signal does come to the center of the screen.

f. Switch to 1 MHz/div. and center the signal.

g. Switch back to 300 kHz/div. The signal should snap back to the center.

h. Verify that acquisition occurs in all Bands -2 divisions from center.

3-49. FM Calibration

a. Check the FM resistor on the Yig Driver Board by setting the Analyzer's Scan Width to 1 MHz/div. and the IF Bandwidth to 10 kHz/div. in Band 2. Using the Hewlett-Packard 8406A set at 1 MHz, ten lines should appear, one per division. If not, use a decade box to vary the resistance until a comb line appears on every graticule.

3-50. VSA

a. Set the analyzer to Band 4 with Fo at 11 GHz. Set the RF Attenuator to 0 dB and the IF Attenuator to some convenient reference such that the 11 GHz comb line falls on a horizontal division line.

b. Switch the analyzer to Band 5 with Fo at 11 GHz. Adjust the Band 5 VSA until the signal returns to the reference level of paragraph 19.1

c. Return to Band 4 and set the analyzer Fo to 7 GHz and set a convenient reference as in paragraph 19.1. Switch the analyzer to Band 3 and set the Band 3 VSA.

d. Repeat for appropriate bands. NOTE: In Band 1 put 20 dB on the RF attenuator before setting the Band 1 VSA.

3-51. 100 MHz Cal. Out

a. Using a signal generator, and a power meter, and another Spectrum Analyzer set a reference at 100 MHz @ -30 dBm on the other Spectrum Analyzer.

b. Take the 100 MHz output of the 727 and place it into the input of the reference analyzer. Compare amplitudes.

c. If they are not equal ±.5 dB, adjust the 100 MHz adjust pot of the 100 MHz oscillator until it meets the ±.5 dB spec.

3-52. Auxiliary Power Connector (Back Panel)

Check J25 for the following connections:

J25	
Pin 1	J1-12
3-4-5	Ground
Pin 14	Sweep Out
16	+18 VDC
18	Video Out
20	-18 VDC
22	Blanking Out

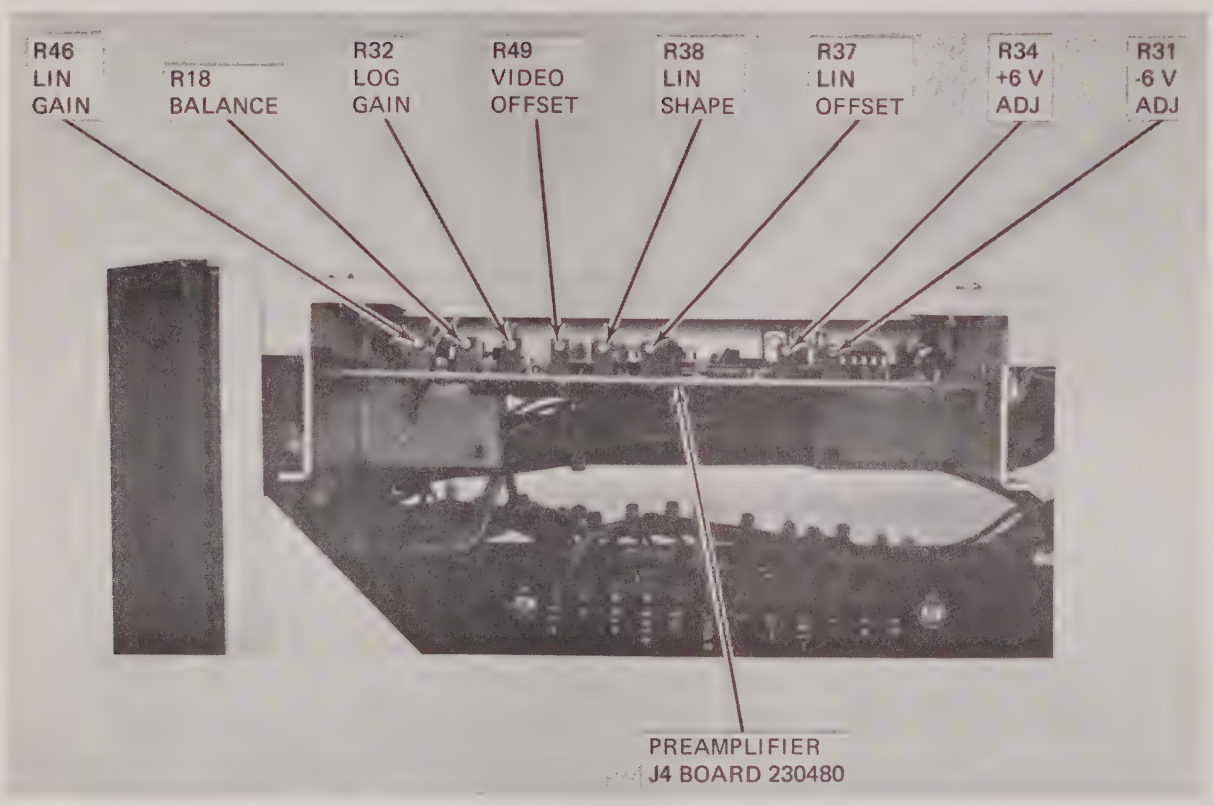


Figure 3-10. Preamplifier J4 Board (230480), Adjustment Locations

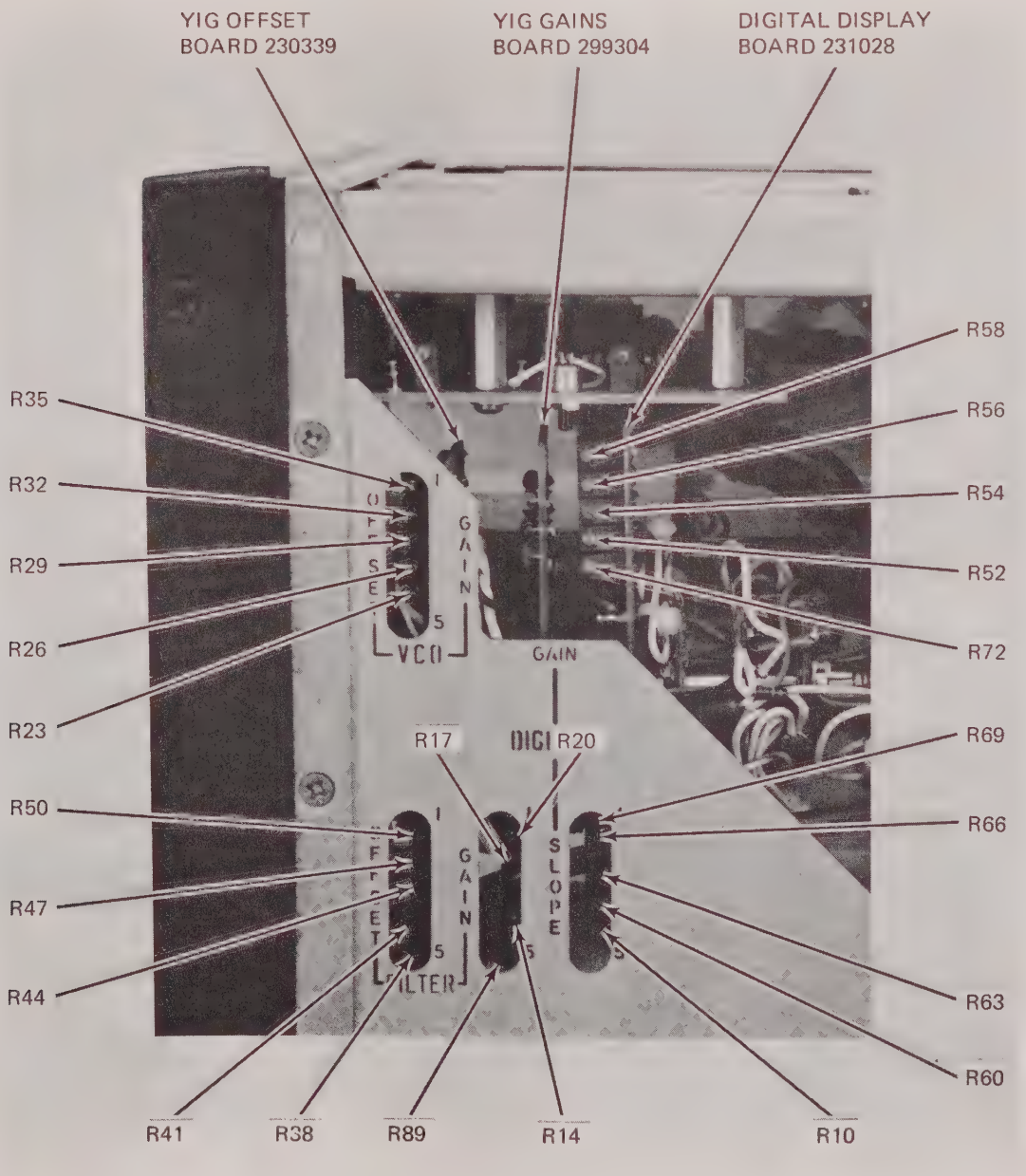


Figure 3-11. RF RANGE Switch (299302), Adjustment Locations

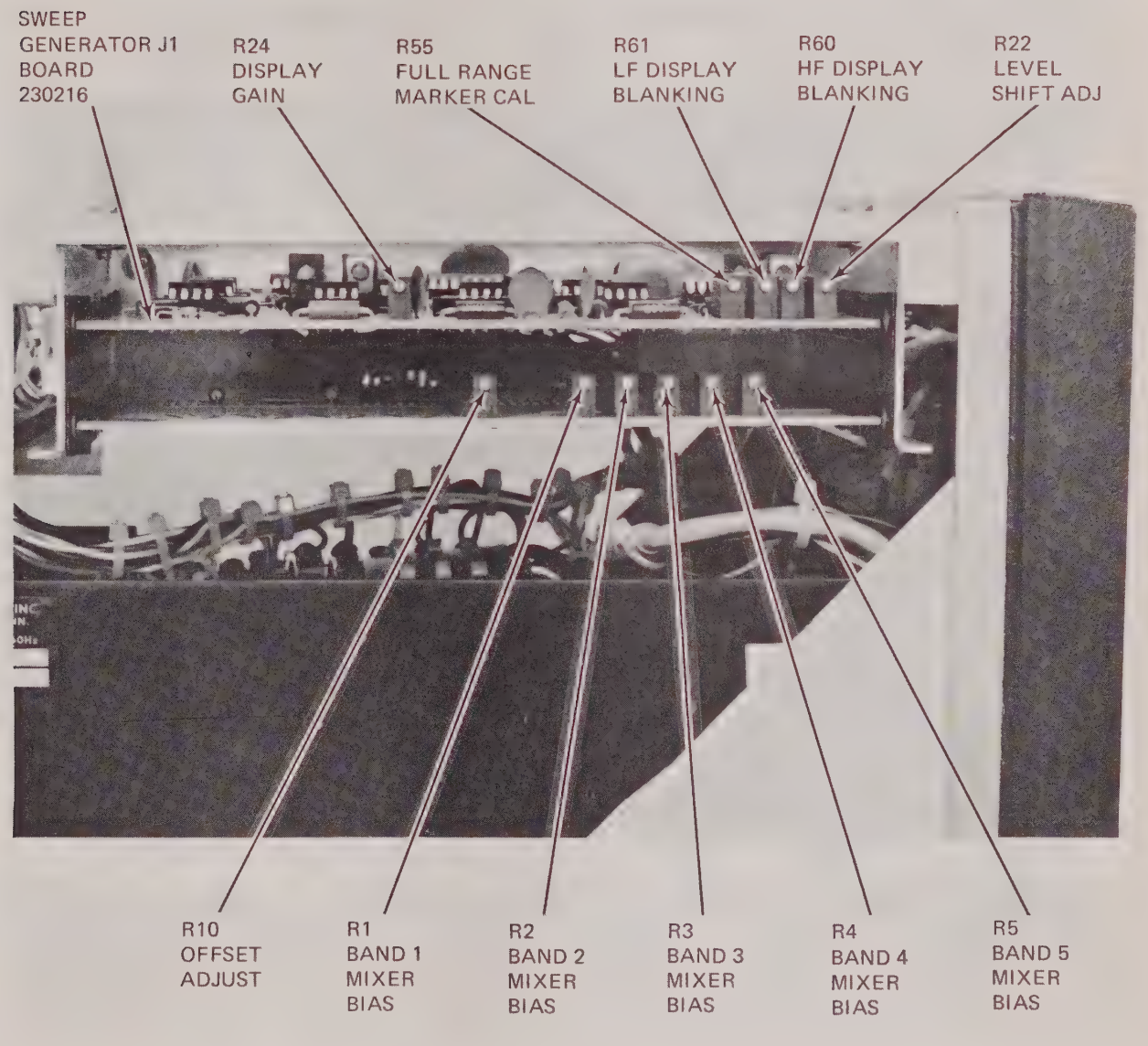

SWEEP GENERATOR J1 BOARD 230216
R24 DISPLAY GAIN
R55 FULL RANGE MARKER CAL
R61 LF DISPLAY BLANKING
R60 HF DISPLAY BLANKING
R22 LEVEL SHIFT ADJ
R10 OFFSET ADJUST
R1 BAND 1 MIXER BIAS
R2 BAND 2 MIXER BIAS
R3 BAND 3 MIXER BIAS
R4 BAND 4 MIXER BIAS
R5 BAND 5 MIXER BIAS

Figure 3-12. Sweep Generator J1 Board (230216) Adjustment Locations Bias Interface J2 Board (299344) Adjustment Locations

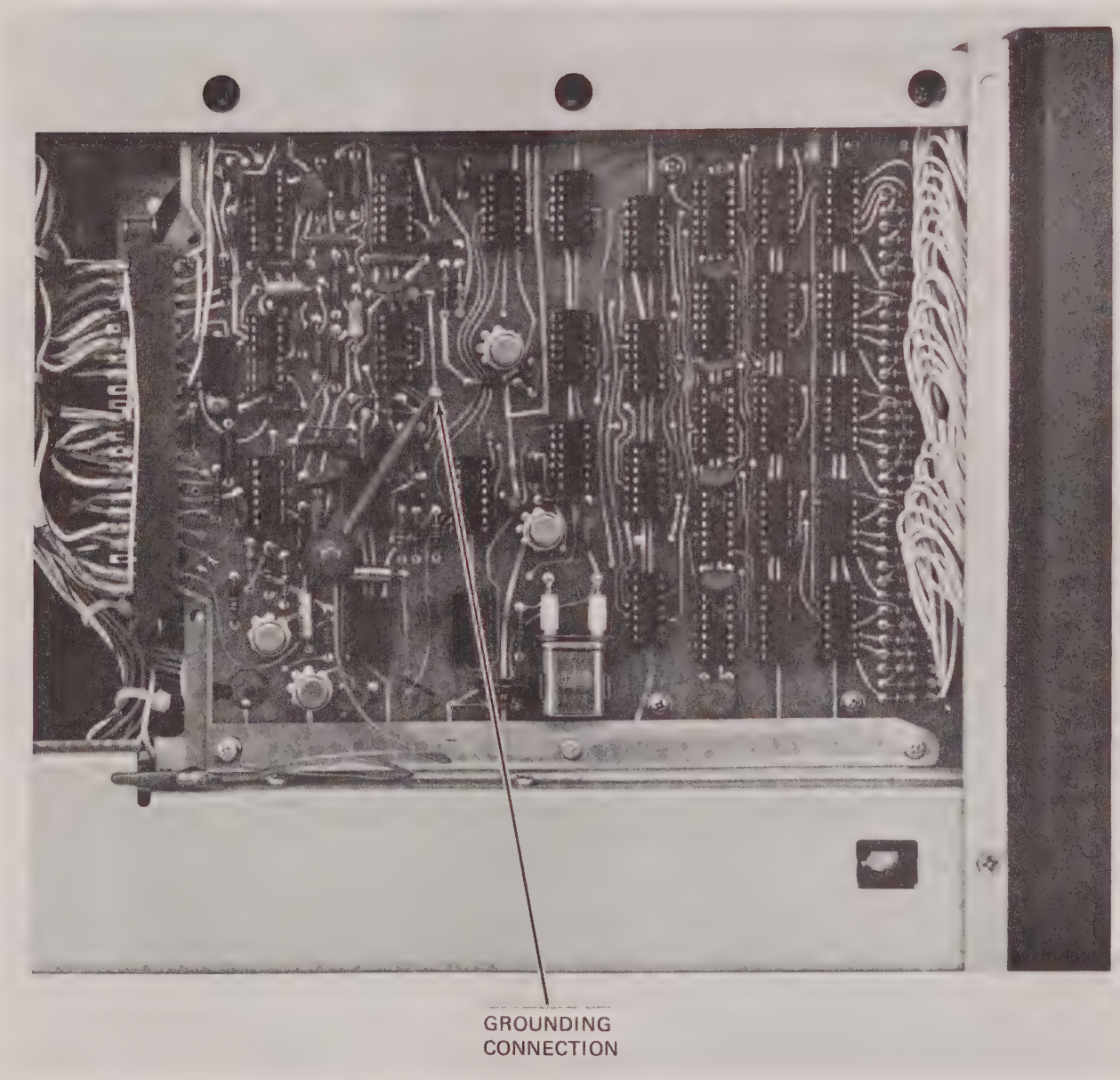
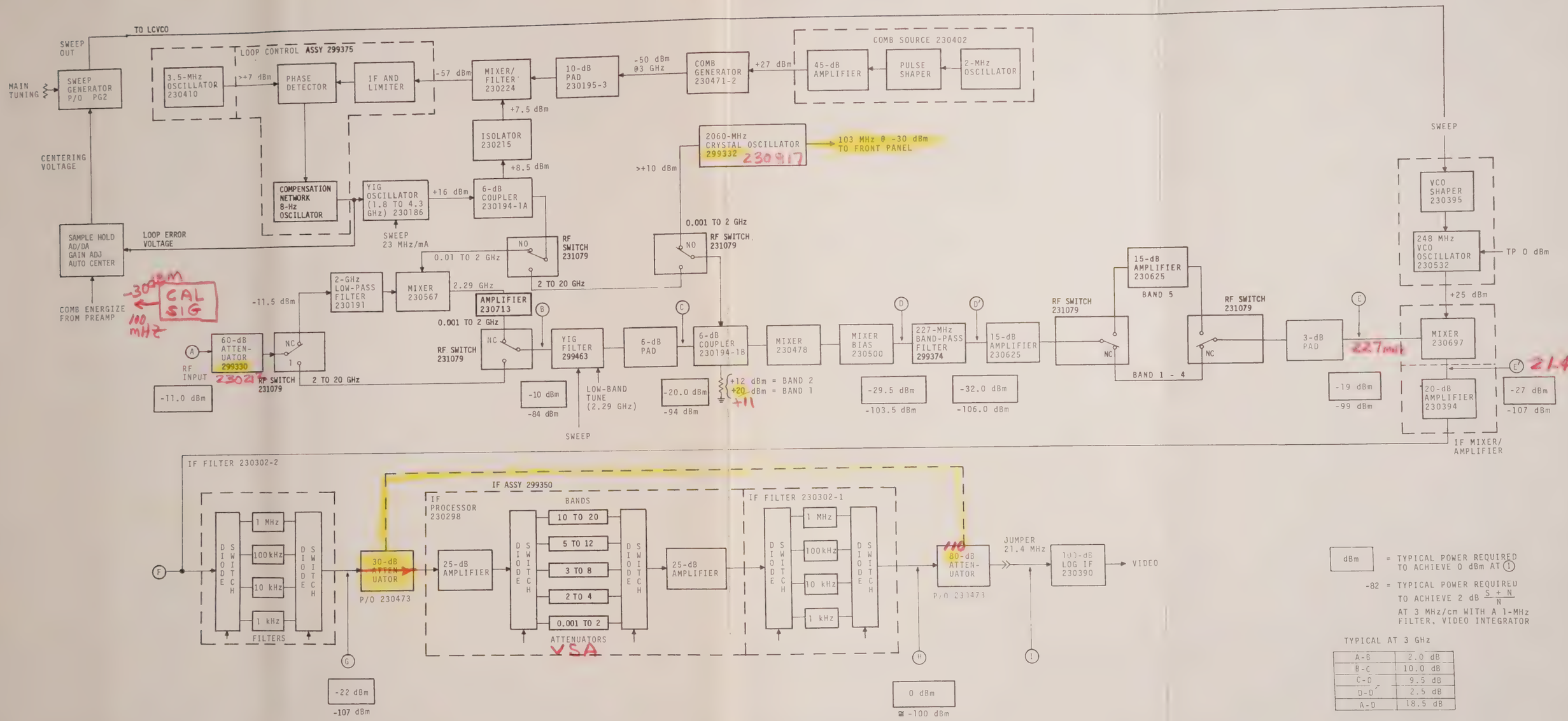


Figure 3-13. Grounding Connection on Digital Display J3 Board (299468)

3-53. DRAWINGS

Block diagrams, wiring diagrams, and connector pin location diagrams are provided here as an aid to troubleshooting and isolation of faulty components. It should be noted that schematic diagrams and parts location illustrations and parts lists are found in Chapter 4 of this manual. The drawings provided here are listed below.

Figure 3-14. AILTECH 727 Spectrum Analyzer Detailed Block Diagram
Figure 3-15. AILTECH 727 Spectrum Analyzer Wiring Diagram
Figure 3-16. Display Unit Wiring Diagram
Figure 3-17. SCAN WIDTH Switch S1 Wiring Diagram
Figure 3-18. SCAN TIME Switch S2 Wiring Diagram
Figure 3-19. RF RANGE Switch S3 Wiring Diagram
Figure 3-20. BANDWIDTH Switch S4 Wiring Diagram
Figure 3-21. AMPLITUDE RANGE Switch S5 Wiring Diagram
Figure 3-22. SCAN MODE Switch S6 Wiring Diagram
Figure 3-23. Tuner Assembly Wiring Diagram
Figure 3-24. PC Board Connector Pin Locations



dBm = TYPICAL POWER REQUIRED TO ACHIEVE 0 dBm AT (1)

-82 = TYPICAL POWER REQUIRED TO ACHIEVE 2 dB $\frac{S+N}{N}$ AT 3 MHz/cm WITH A 1-MHz FILTER, VIDEO INTEGRATOR

TYPICAL AT 3 GHz

A-B	2.0 dB
B-C	10.0 dB
C-D	9.5 dB
D-D'	2.5 dB
A-D	18.5 dB

Figure 3-14. AILTECH 727 Spectrum Analyzer Detailed Block Diagram

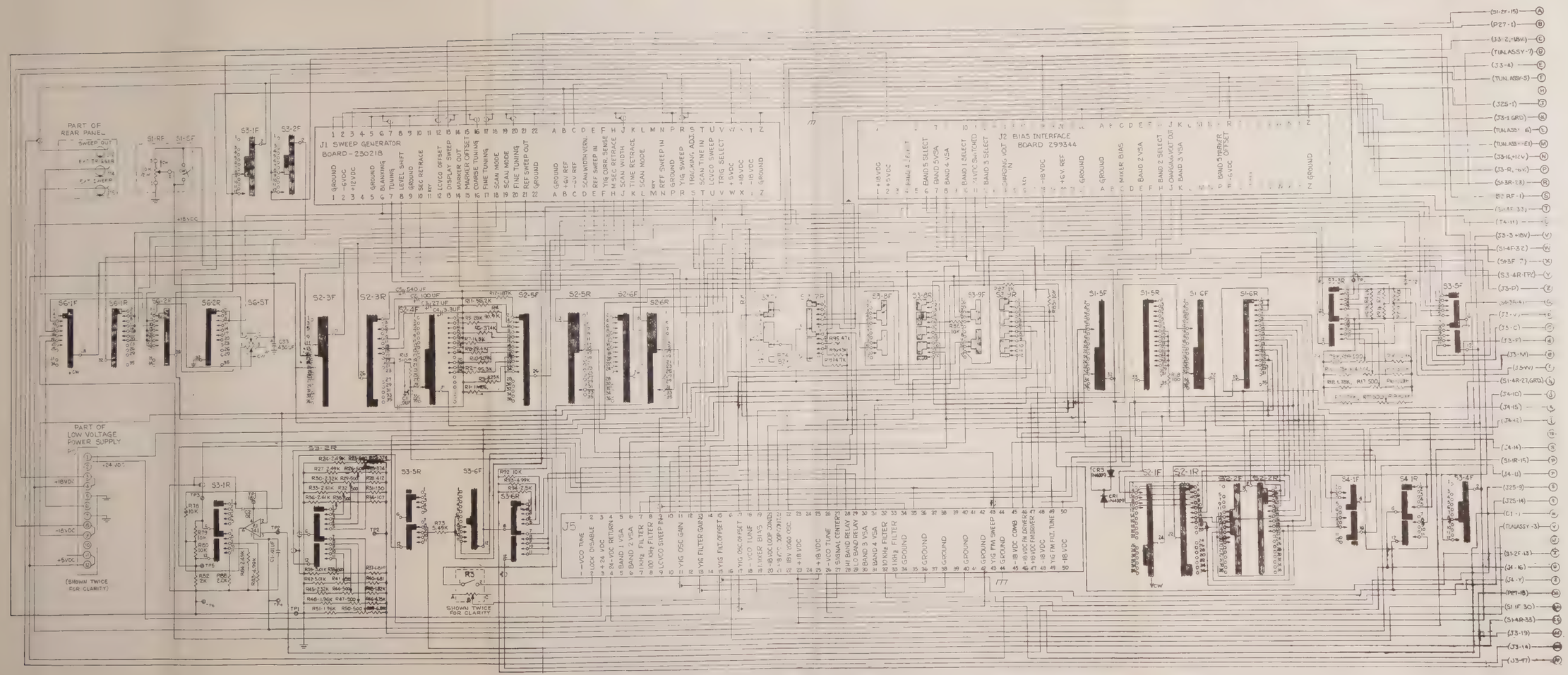

PART OF REAR PANEL
J1 SWEEP GENERATOR BOARD-230218
J2 BIAS INTERFACE BOARD 299344
PART OF LOW VOLTAGE POWER SUPPLY
(SHOWN TWICE FOR CLARITY)
SHOWN TWICE FOR CLARITY

Figure 3-15. AILTECH 727 Spectrum Analyzer Wiring Diagram (Sheet 1 of 3)

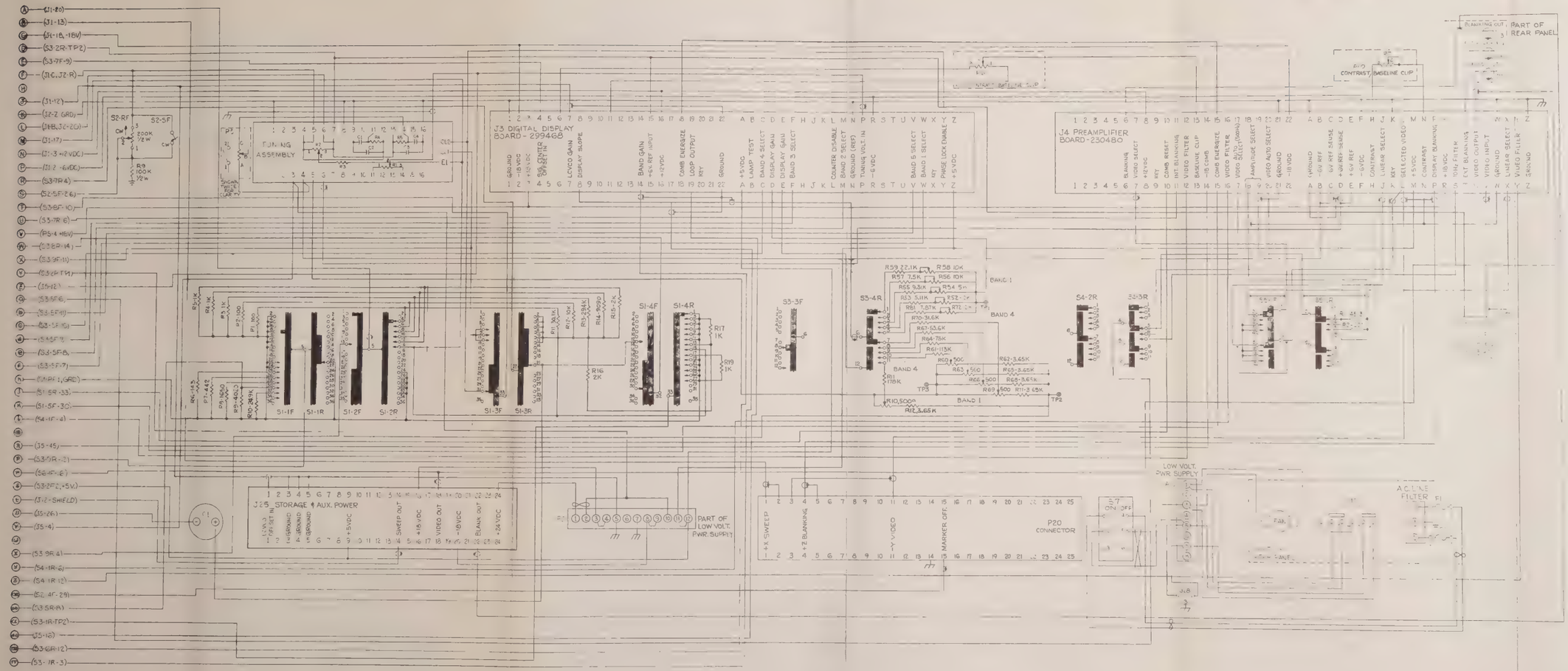


Figure 3-15. AILTECH 727 Spectrum Analyzer Wiring Diagram (Sheet 2 of 3)

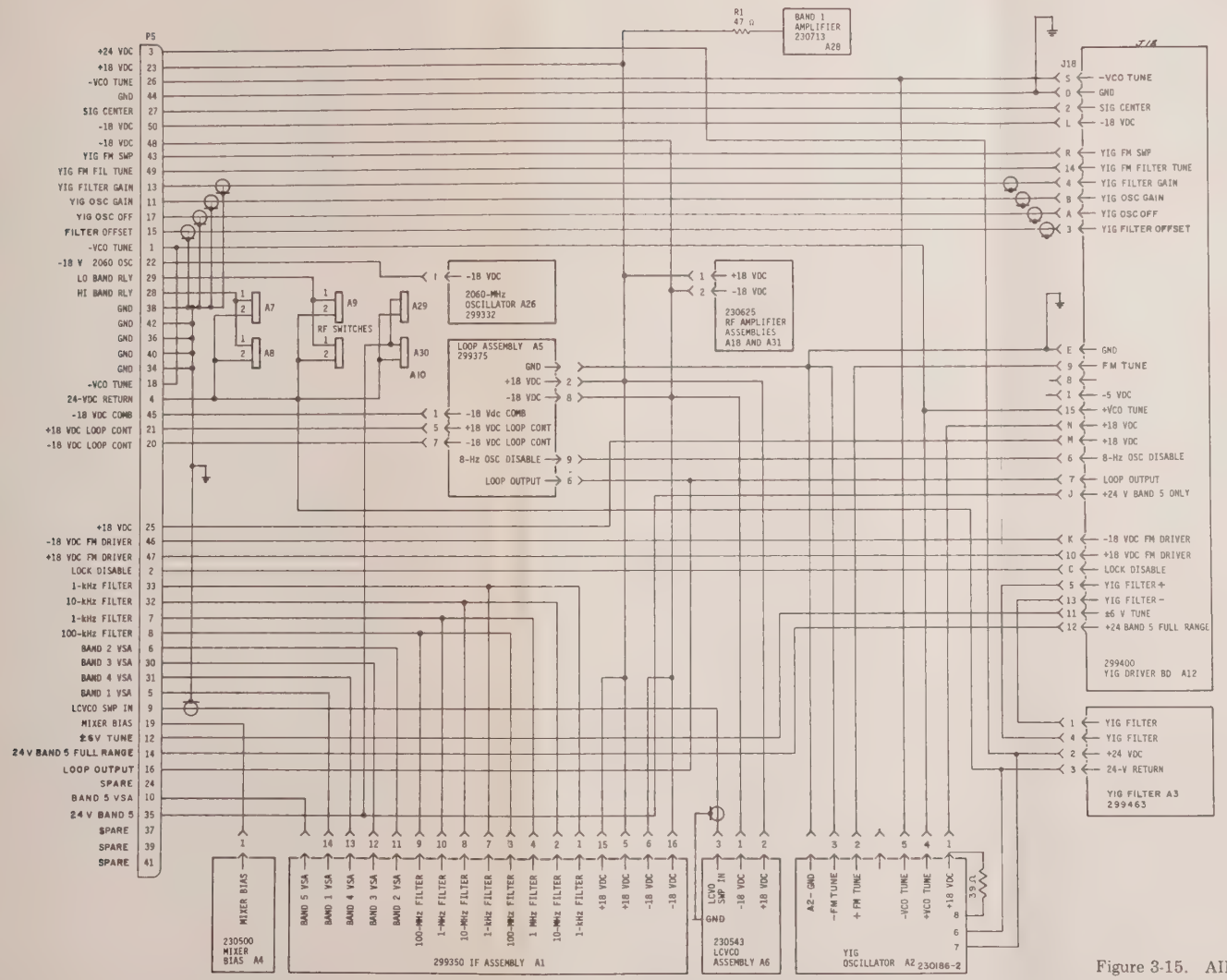


Figure 3-15. AILTECH 727 Spectrum Analyzer Wiring Diagram (Sheet 3 of 3)

(Refer to applicable Display manual.)

Figure 3-16. Display Unit Wiring Diagram

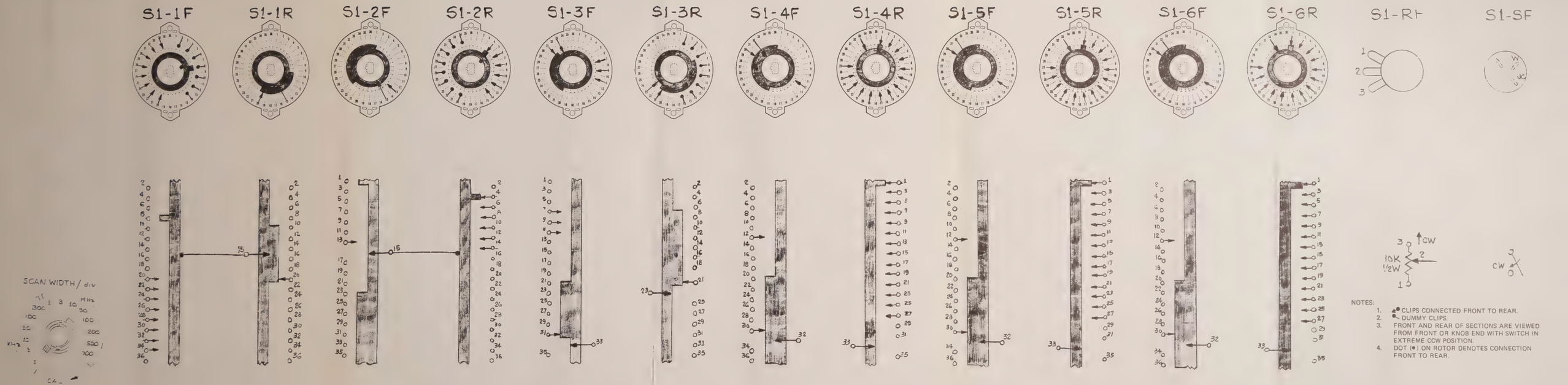
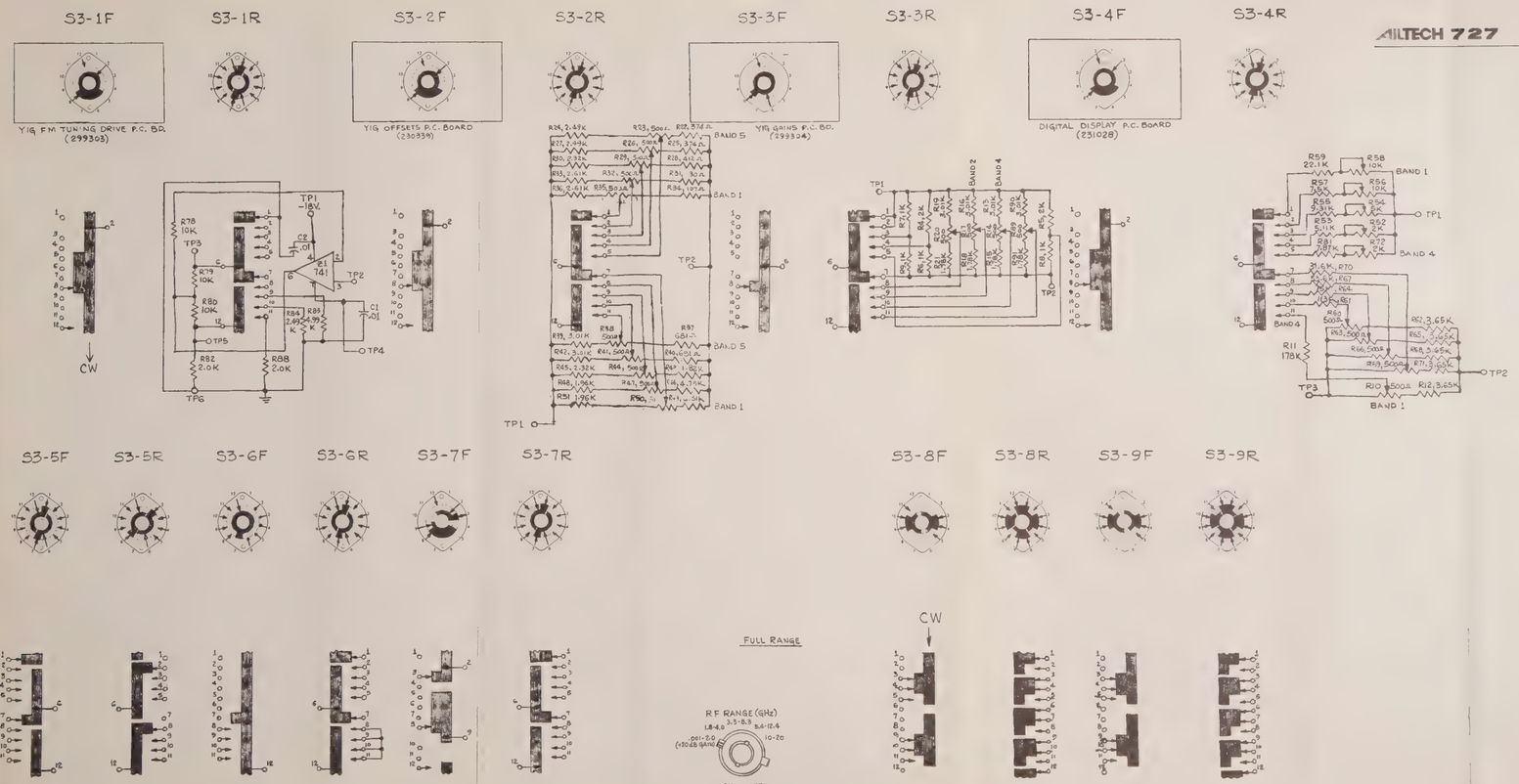


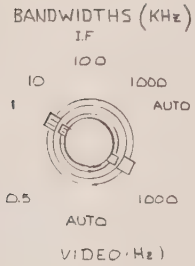
Figure 3-17. SCAN WIDTH Switch S1 Wiring Diagram



NOTES:

1. ▲ CLIPS CONNECTED FRONT TO REAR.
2. ● DUMMY CLIPS.
3. FRONT AND REAR OF SECTIONS ARE VIEWED FROM FRONT, OR KNOB END, WITH SWITCH IN EXTREME CCW POSITION.

Figure 3-19. RF RANGE Switch S3 Wiring Diagram



NOTES:

1. CLIPS CONNECTED FRONT TO REAR.
2. DUMMY CLIPS.
3. FRONT AND REAR OF SECTIONS ARE VIEWED FROM FRONT, OR KNOB END, WITH SWITCH IN EXTREME CCW POSITION.

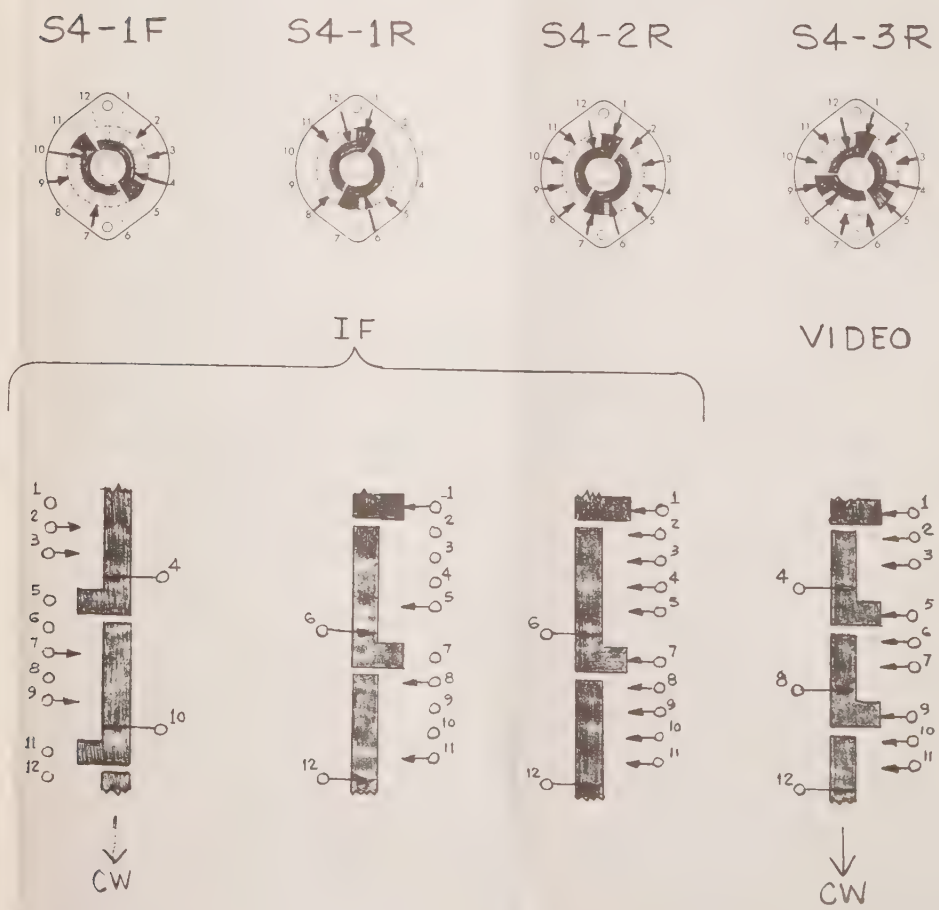


Figure 3-20. BANDWIDTH Switch S4 Wiring Diagram

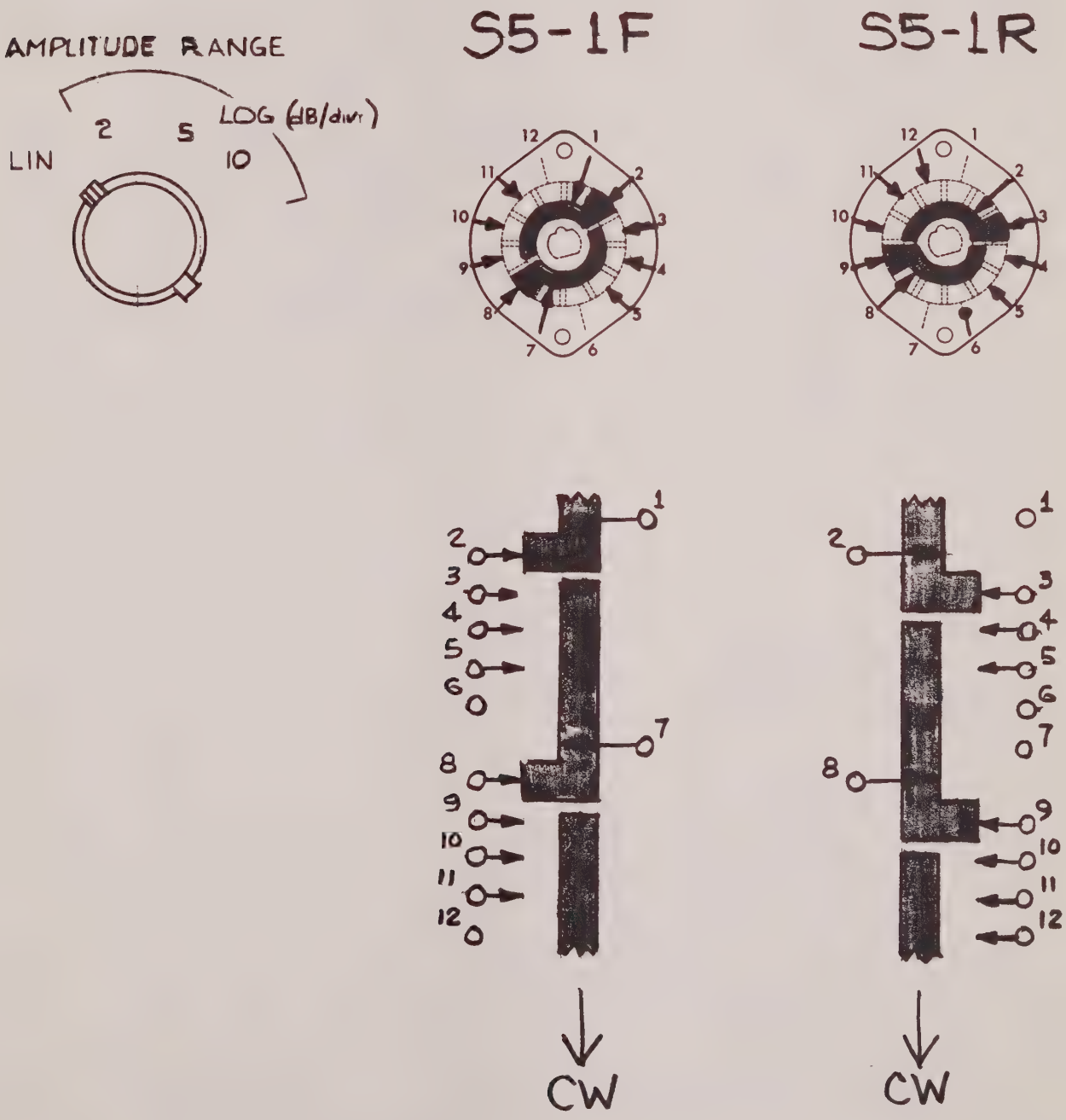
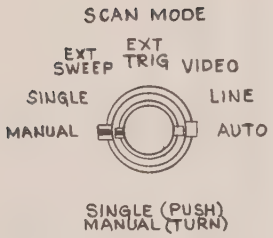
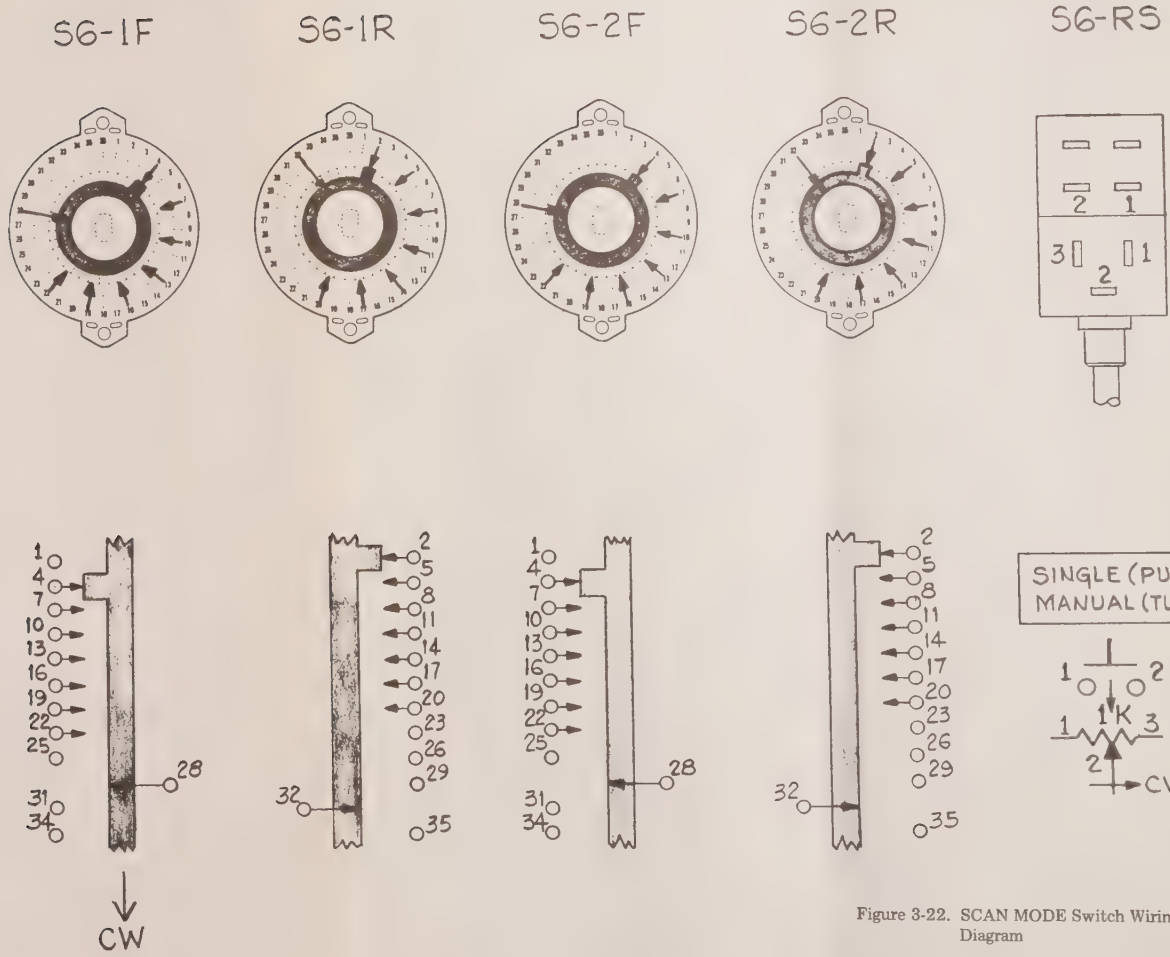


Figure 3-21. AMPLITUDE RANGE Switch S5 Wiring Diagram





NOTES:
1. CLIPS CONNECTED FRONT TO REAR.
2. DUMMY CLIPS.
3. FRONT AND REAR OF SECTIONS ARE VIEWED FROM FRONT, OR KNOB END, WITH SWITCH IN EXTREME CCW POSITION.

Figure 3-22. SCAN MODE Switch Wiring Diagram

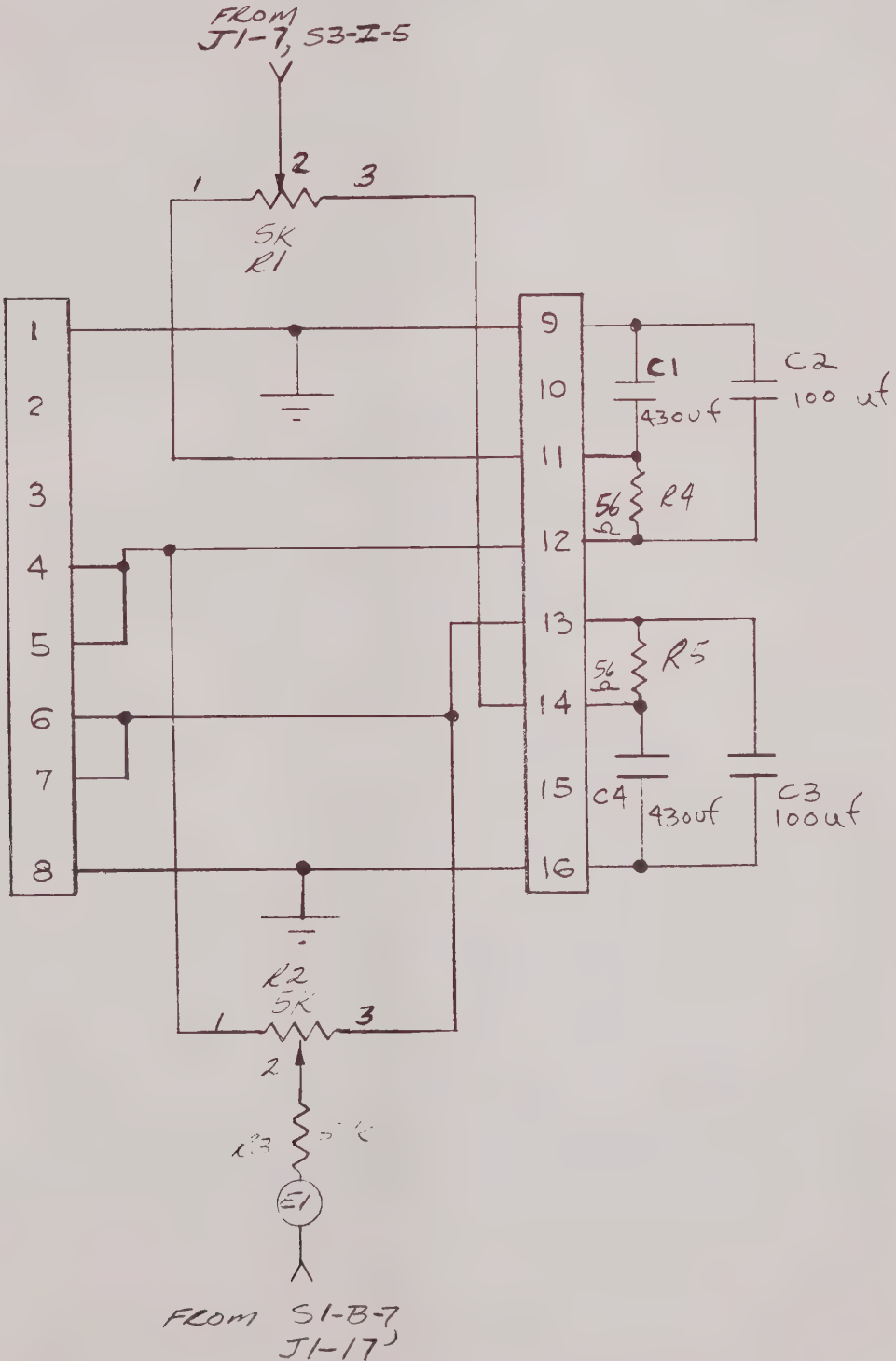


Figure 3-23. Tuner Assembly Wiring Diagram

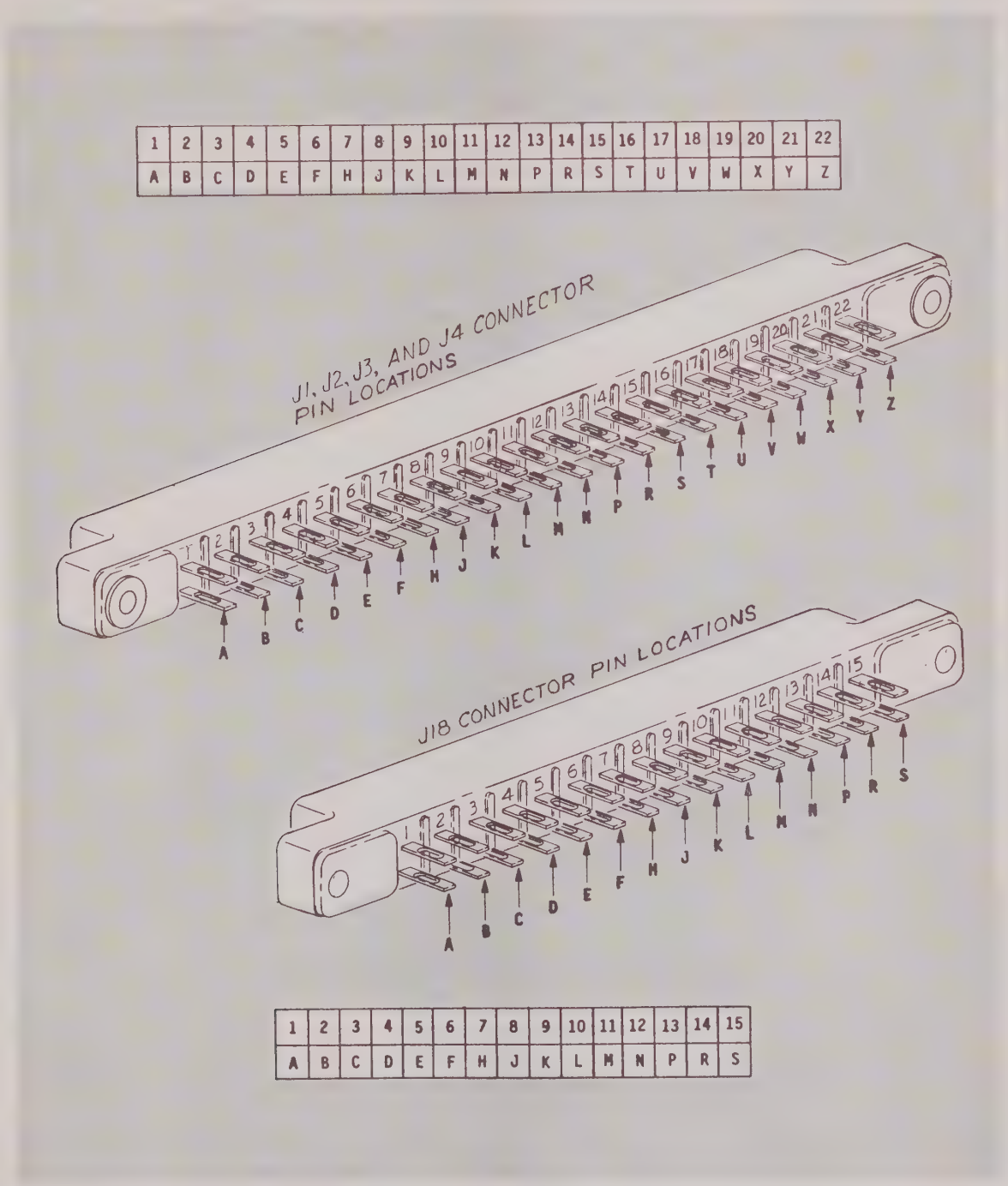

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
A B C D E F H J K L M N P R S T U V W X Y Z
J1, J2, J3, AND J4 CONNECTOR PIN LOCATIONS
J18 CONNECTOR PIN LOCATIONS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
A B C D E F H J K L M N P R S

Figure 3-24. PC Board Connector Pin Location

CHAPTER 4

PARTS LOCATION

SECTION I. GENERAL

The preliminary information in this chapter consists of photographs and schematic diagrams which identify and locate most of the replaceable electrical components. A complete parts list will be provided at a later date. Refer to Table 4-1 for the federal manufacturers code to name conversions.

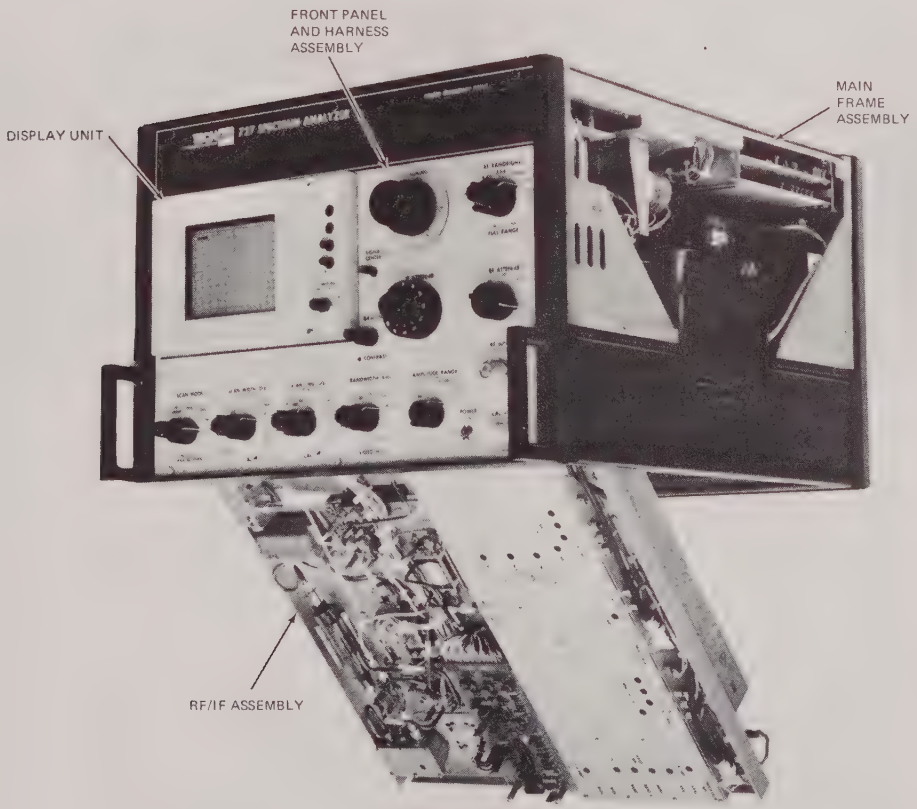


Figure 4-1. AILTECH 727 Spectrum Analyzer Component Parts

Table 4-1. Federal Supply Code Manufacturer (FSCM)

FSCM	Manufacturer	City - State	Zip Code
00141	PIC Design Corp.	Ridgefield, CT.	06877
00656	Aerovox Corp.	New Bedford, MA.	02741
00752	AIL Div. of Cutler Hammer	Deer Park, N.Y.	11729
01121	Allen Bradley Co.	Milwaukee, WI.	53212
01295	Texas Instruments, Inc.	Dallas, TX.	75222
02660	Bunker Ramo Corp.	Broadview, IL.	60153
03508	General Elect. Co.	Syracuse, N.Y.	13201
04072	Bell Industries, Inc.	Compton, CA.	90224
04213	Baddell-Burns Mfg. Co.	Mineola, N.Y.	11501
04713	Motorola, Inc.	Phoenix, AZ.	85008
05245	Corcom, Inc.	Chicago, IL.	60657
05820	Wakefield Eng. Inc.	Wakefield, MA.	01880
05955	Edko Electronics, Inc.	Brooklyn, N.Y.	11211
06540	Amatom Electronic	New Haven, CT.	06515
07047	Ross Milton Co., The	Southampton, PA.	18966
07263	Fairchild Semiconductor	Mountainview, CA.	94040
07556	Calabro Plastics, Inc.	Darby, PA.	19082
07886	National Radio Co.	Melrose, MA.	02176
08730	Vemaline Products Co.	Wyckoff, N.J.	07481
09004	Transistor Devices Inc.	Cedar Knolls, N.J.	07927
09969	Dale Electronics Inc.	Yankton, SD.	57078
13103	Thermaloy Co.	Dallas, TX.	75234
14099	Semtech Corp.	Newbury Park, CA.	91320
14655	Cornell-Dubilier Electronics	Newark, N.J.	07101
16733	Phelps Dodge Communications Co.	North Haven, CT.	06473
19647	Caddock Electronics, Inc.	Riverside, CA.	92507
23936	Pamator Div. William J. Purdy Co.	Burlingame, CA.	94010
25403	Amperex Electronic Corp.	Slatersville, RI	02876
26742	Methode Electronics Inc.	Chicago, IL.	60656
27193	Cutler Hammer Inc., Specialty Prod. Div.	Milwaukee, WI.	53216
27264	Molex Products Co.	Downers Grove, IL.	60515
27907	Plastimatic Inc.	West Nyack, N.Y.	10994
29604	Stackpole Components Co.	Raleigh, N.C.	27610
46384	Penn Engineering and Mfg. Co.	Doylestown, PA.	18901
49956	Raytheon Co.	Lexington, MA.	02173
50056	Gulton Industries Inc.	Metuchen, N.J.	08840
50436	Hewlett-Packard Co.	Palo Alto, CA.	94304
50930	Acushnet Capacitor Co.	Bedford, MA.	02741
56289	Sprague Electric Co.	North Adams, MA.	01247
70485	Atlantic India Rubber Works Inc.	Chicago, IL.	60607
71279	Cambridge Thermionic Corp.	Cambridge, MA.	02138
71400	Bussman Mfg.	St. Louis, MO.	63107
71450	CTS Corp.	Elkhart, IN.	46514
71590	Centralab Electronics	Milwaukee, WI.	53201
71744	Chicago Miniature Lamp Works	Chicago, IL.	60640
71785	TRW Electronic Components	Elk Grove Village, IL.	60007
71895	Delavan Mfg. Co.	West Des Moines, IA.	50265

Table 4-1. Federal Supply Code Manufacturer (FSCM) (cont.)

FSCM	Manufacturer	City - State	Zip Code
72136	Electro Motive Mfg. Co.	Williamantic, CT.	06226
72962	Elastic Stop Nut Div.	Union, N.J.	07083
72982	Erie Technological Products Inc.	Erie, PA.	16512
73899	JED Electronics Corp.	Brooklyn, N.Y.	11219
74389	Ulanet George Co.	Newark, N.J.	07105
74868	Bunker Ramo Corp.	Danbury, CT.	06810
74970	Johnson, E.F. Co.	Waseca, MN.	56093
75042	TRW Electronic Components	Philadelphia, PA.	19108
75382	Kulka Electric Corp.	Mt. Vernon, N.Y.	10550
75915	Littlefuse, Inc.	Des Plains, IL.	60016
78488	Stackpole Carbon Co.	St. Mary's, PA.	15857
78553	Tinnerman Products, Inc.	Cleveland, OH.	44129
79136	Waldes Kohindoor Inc.	Long Island City, N.Y.	11101
79963	Zierick Mfg. Co.	Mt. Kisco, N.Y.	10549
80058	Joint Electronic Type Des. System		
80294	Bourns Inc. Instrument Div.	Riverside, CA.	92506
81349	Military Spec. Promulgated by Military Depts.		
81844	Guardian Electric Mfg. Co.	Culver City, CA.	90230
82877	Rotron, Inc.	Woodstock, N.Y.	12498
83330	Smith, Herman H. Co.	Brooklyn, N.Y.	11207
83553	Associated Spring Corp.	Gardena, CA.	90248
88044	Aeronautical Standards Group Dept.		
91506	Augat Inc.	Attleboro, MA.	02703
91833	Keystone Electronics Corp.	New York, N.Y.	10012
95263	Leecraft Mfg. Co. Inc.	Long Island City, N.Y.	11101
95354	Methode Manufacturing Corp.	Rolling Meadows, IL.	60008
97469	Airco Speer Carbon, Graphite Div.	Niagara Falls, N.Y.	14302
98291	Sealectro Corp.	Mamaroneck, N.Y.	10544
99800	American Precision Ind. Inc.	East Aurora, N.Y.	14052

AILTECH 727 SPECTRUM ANALYZER COMPONENT PARTS

Item	Description	Manufacturer	Part No.
AT1	RF Attenuator (see Figure 4-2)	00752	299330
B1	Fan, Axial (see Figure 4-23)	82877	M747
B1W1	Plug and Cord (see Figure 4-23)	82877	16415
C1	Capacitor, powerlytic 4600 μF 15 V (see Figure 4-15)	56289	36D462G015AA2A
FL1	AC Line Filter (see Figure 4-23)	05245	3B4
F1, F2	Fuse, Slo-Blo, 3 amp 125 V (see Figure 4-23)	75915	313003
PS1	Power Supply (see Figure 4-21)	00752	230426-1
S7/R3	Resistor, variable, 10 K push-pull switch (see Figure 4-2)	71450	VY9810
W1	Cable Assembly, RF input (see Figure 4-2)	00752	230633-23
W2	Cable Assembly (see Figure 4-2)	00752	230633-22
	Sweep Generator J1 Board (see Figure 4-16)	00752	230216
	Tuner Assembly (see Figure 4-14)	00752	299137-1
	Digital Display J3 Board (see Figure 4-18)	00752	299468
	Bias Interface Board	00752	299344
	Tuner/Voltage Ref. Assembly	00752	299480-1
	Automatic Centering Board	00752	299378
	RF/IF Assembly	00752	299352
	100 MHz Cal. Oscillator Assy.	00752	295040
	RF Range (GHz) Switch S3 (see Figure 4-5)	00752	230334
		00752	
	Log IF Amplifier (see Figure 4-22)	00752	230390
	IF Attenuator Assembly (see Figure 4-13)	00752	299367
	Preamplifier J4 Board (see Figure 4-20)	00752	230480

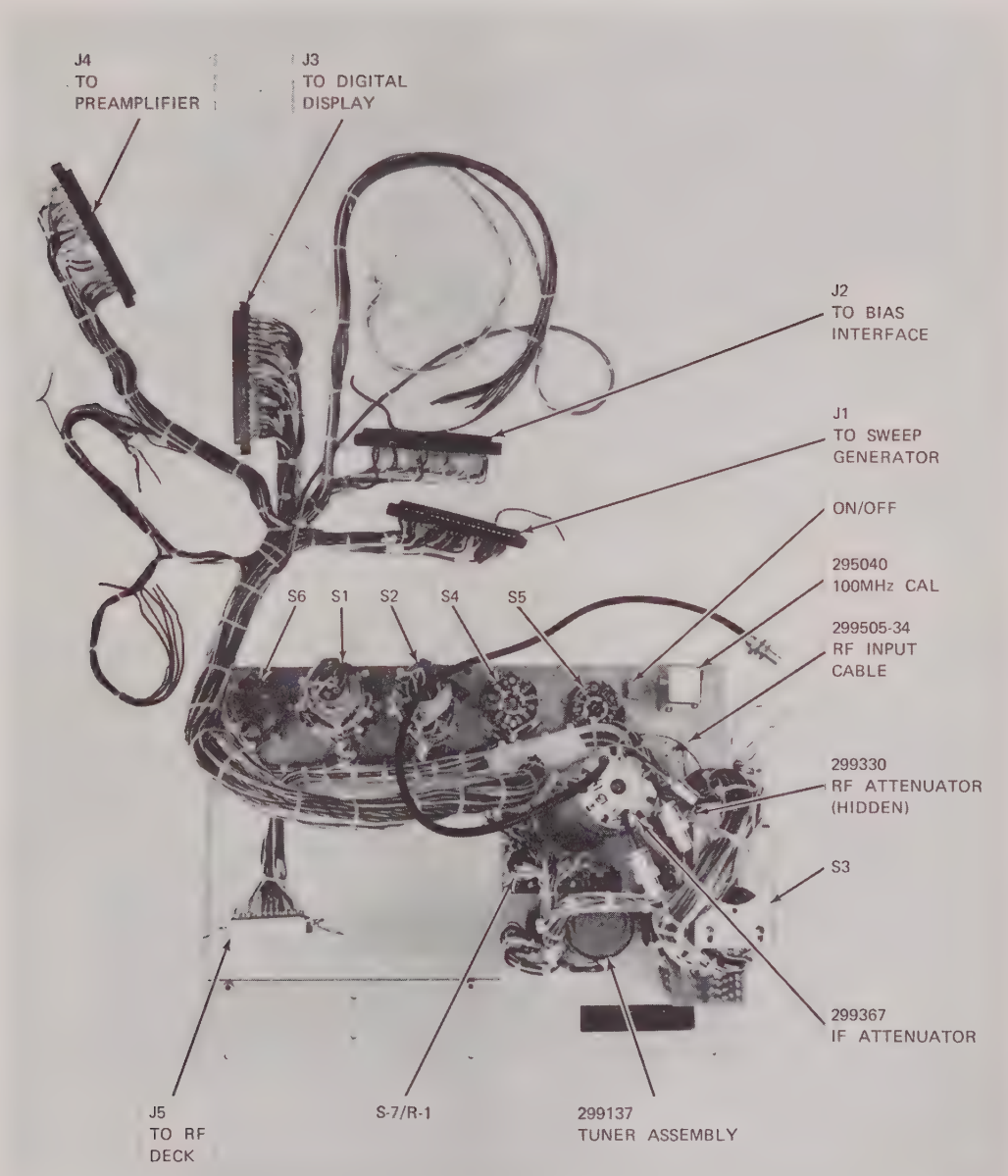


Figure 4-2. Front Panel and Harness Assembly

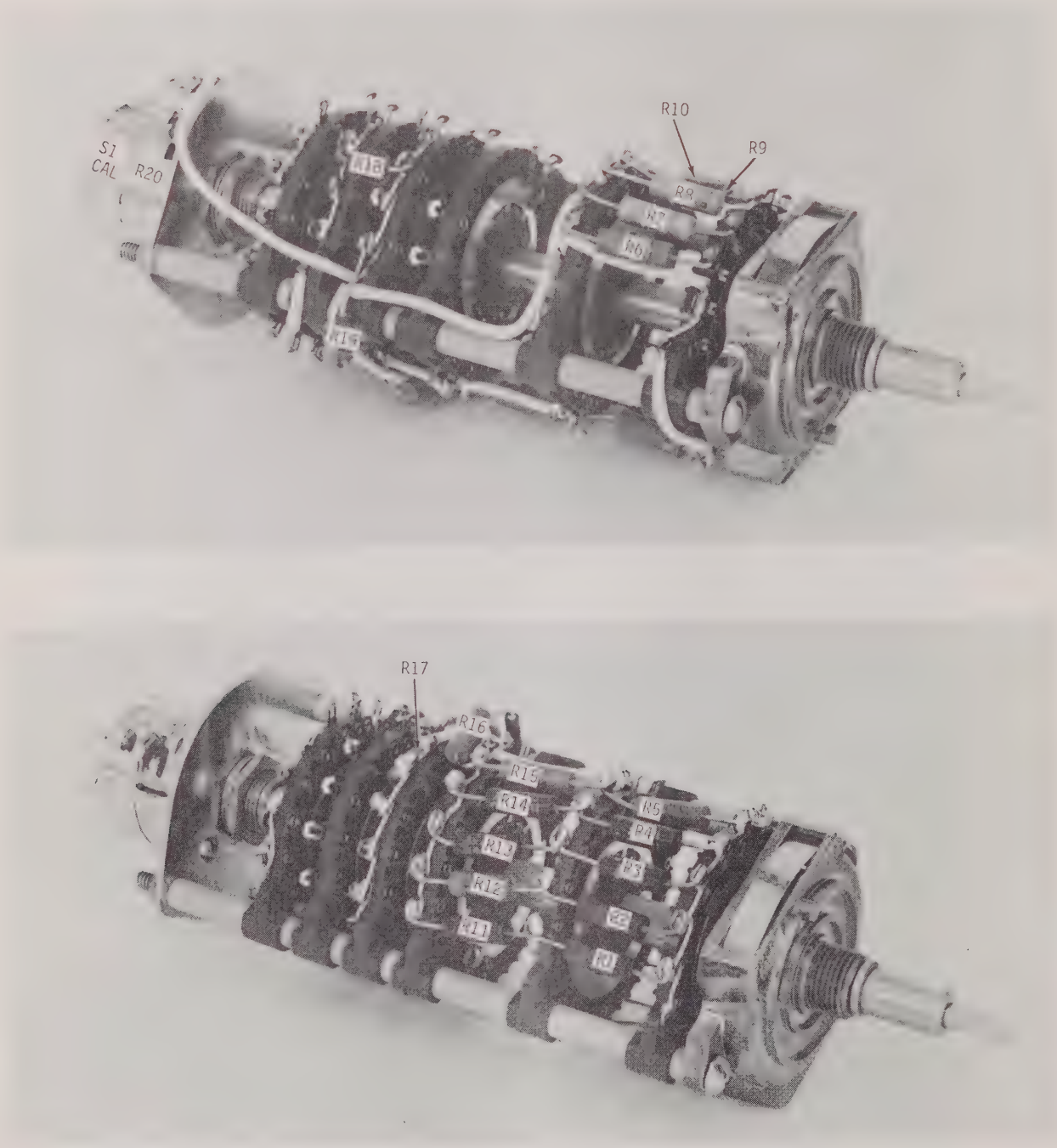


Figure 4-3. SCAN WIDTH Switch S1 (299475)

SCAN WIDTH SWITCH S1 (299475)

Item	Description	FMC	Part No.
R1, R2	Resistor, 100, 1/8 W	81349	RN60C1000F
R3, R4	Resistor, 1 k, 1/8 W	81349	RN60C1001F
R5	Resistor, 1 k, 1/8 W	81349	RN60C1001F
R6	Resistor, 143, 1/8 W	81349	RN60C1430F
R7	Resistor, 442, 1/8 W	81349	RN60C4420F
R8	Resistor, 1.65 k, 1/8 W	81349	RN60C1651F
R9	Resistor, 4.02 k, 1/8 W	81349	RN60C4021F
R10	Resistor, 24.9 k, 1/8 W	81349	RN60C2492F
R11	Resistor, 30.1 k, 1/8 W	81349	RN60C3012F
R12	Resistor, 10 k, 1/8 W	81349	RN60C1002F
R13	Resistor, 29.4 k, 1/8 W	81349	RN60C2942F
R14	Resistor, 9.09 k, 1/8 W	81349	RN60C9091F
R15, R16	Resistor, 2 k, 1/8 W	81349	RN60C2001F
R17	Resistor, 1 k, 1/8 W	81349	RN60C1001F
R18	Resistor, 100, 1/4 W	81349	RC07GF101J
R19	Resistor, 1 k, 1/4 W	81349	RC07GF102J

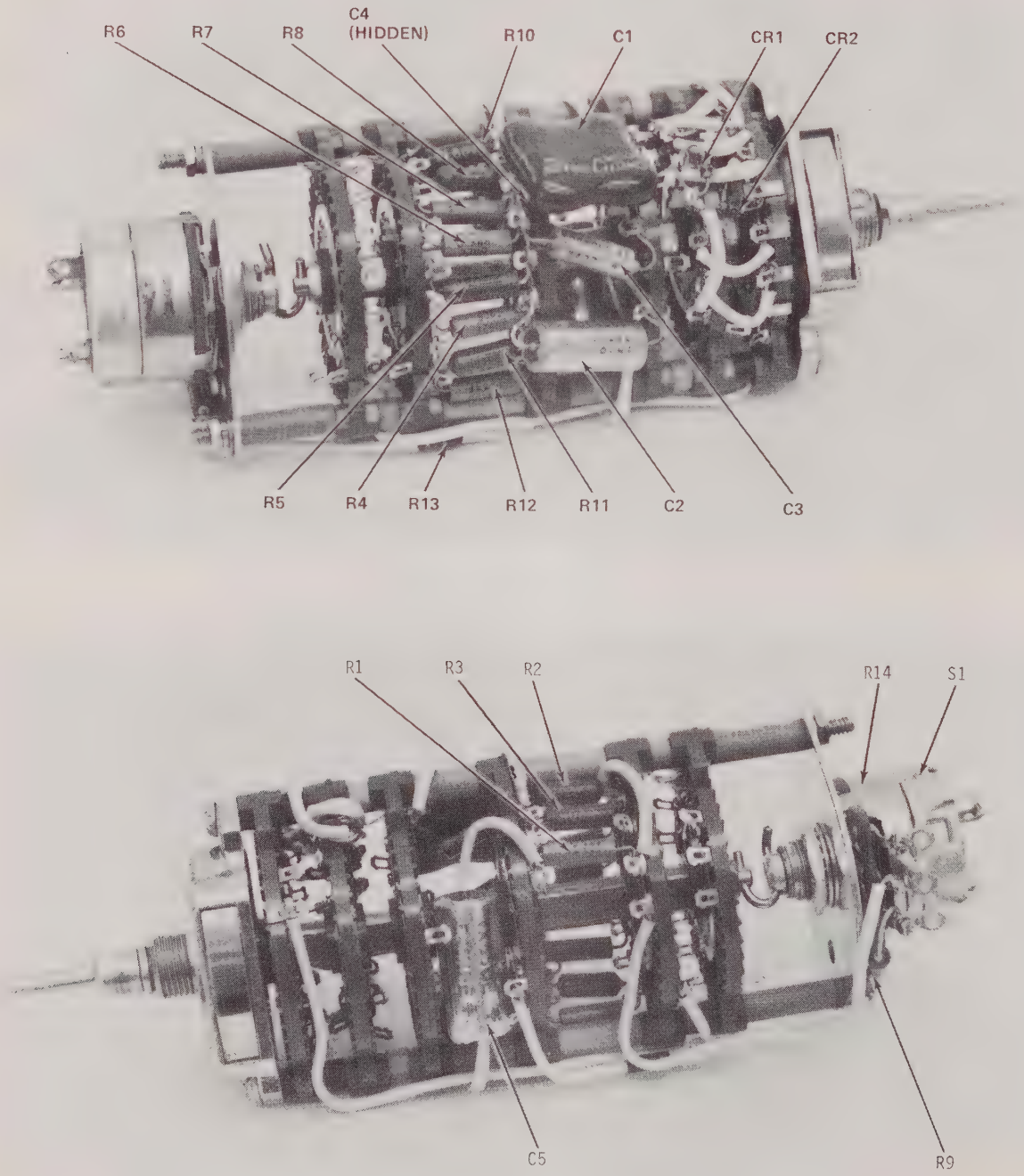


Figure 4-4. SCAN TIME Switch S2 (299476)

SCAN TIME SWITCH S2 (299476)

Item	Description	FMC	Part No.
C1	Capacitor, 0.01 μF	81349	CM07FD103J03
C2	Capacitor, 100 μF	81349	CS13BC107K
C3	Capacitor, 27 μF	81349	CS13BC276K
C4	Capacitor, 3.3 μF, 15 V	81349	M39003/01-5020
C5	Capacitor, 540 μF	14655	TX65BE541KPE
CR1	Diode	03508	1N4009
CR2	Not used		
CR3	Diode	03508	1N4009
R1	Resistor, 464 k, 1/8 W, 1 Meg	81349	RN60D1004F
R2	Resistor, 95.3 k, 1/8 W	81349	RN60C9532F
R3	Resistor, 8.25 k, 1/8 W	81349	RN60C8251F
R4	Resistor, 90.9 k, 1/8 W	81349	RN60C9092F
R5	Resistor, 28 k, 1/8 W	81349	RN60C2802F
R6	Resistor, 37.4 k, 1/8 W	81349	RN60C3743F
R7	Resistor, 11.3 k, 1/8 W	81349	RN60C1132F
R8	Resistor, 29.4 k, 1/8 W	81349	RN60C2942F
R9	Resistor, 100 k, 1/2 W	81349	RC20GF104J
R10	Resistor, 9.09 k, 1/8 W	81349	RN60C9091F
R11	Resistor, 56.2 k, 1/8 W	81349	RN60C5622F
R12	Resistor, 187 k, 1/8 W	81349	RN60C1873F
R13	Resistor, 510, 1/4 W	81349	RC07GF511J
S1/R14	Resistor, variable, 20 k 3A, 125V	71450	WR5314

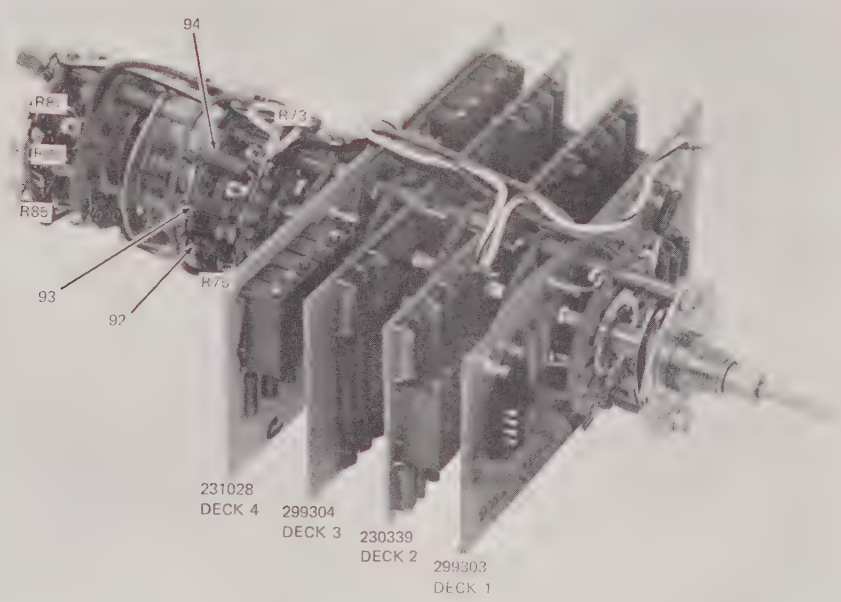


Figure 4-5. RF RANGE Switch S3 (299302)

RF RANGE (GHz) SWITCH S3 (299302)

Item	Description	FMC	Part No.
R73	Resistor, 5.49 k, 1%, 1/8 W	81349	RN60C5491F
R74	Resistor, 82 k, 1/4 W	81349	RC07GF823J
R75	Resistor, 120 k, 1/4 W	81349	RC07GF124J
R76 thru R84	Not used		
R85	Resistor, 10.0 k, 1%, 1/8 W	81349	RN60C1002F
R86	Resistor, 10.0 k, 1%, 1/8 W	81349	RN60C1002F
R87	Resistor, 1 k, 1/4 W	81349	RC07GF102J
R92	Resistor, 10.0 k, 1%, 1/8 W	81349	RN60C1002F
R93	Resistor, 4.99 k, 1%, 1/8 W	81349	RN60C4991F
R94	Resistor, 2.5 k, 1%, 1/8 W	81349	RN60C2501F
R95	Resistor, 4.7 k, 1/4 W	81349	RC07GF472J
R96	Resistor, 4.3 k, 1/4 W	81349	RC07GF432J
R97	Resistor, 4.7 k, 1/4 W	81349	RC07GF472J
Deck 1	YIG FM Tuning Drive Board	00752	2995016
Deck 2	YIG Offset Board	00752	230339
Deck 3	YIG Gains Board	00752	299304
Deck 4	Digital Display Board	00752	231028

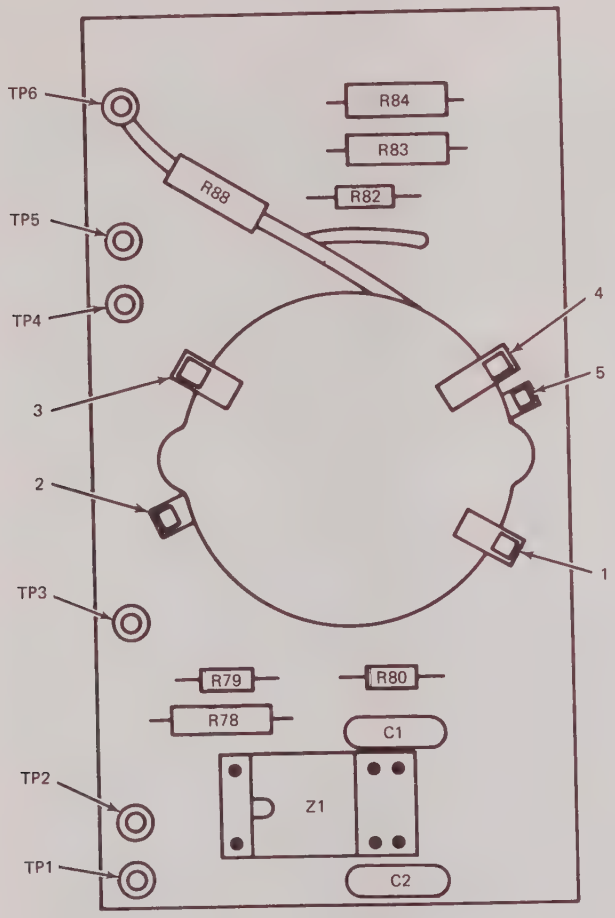


Figure 4-6. Switch S3 Deck 1--YIG FM Tuning Drive Board (299303)

SWITCH S3 DECK 1--YIG FM TUNING DRIVE BOARD (2995016)

Item	Description	FMC	Part No.
C1, C2	Capacitor, 0.01 μF	56289	5HKS-S10
R79 thru R80	Resistor, 10 k, 1/8 W	81349	RN60C1002F
R81	Not used		
R82	Resistor, 2 k, 1/8 W	81349	RN60C2000F
R83	Resistor, 4.99 k, 1/8 W	81349	RN60C4991F
R84	Resistor, 2.49 k, 1/8 W	81349	RN60C2491F
R88	Resistor, 2 k, 1/8 W	81349	RN60C2000F
Z1	IC	01295	SN72741P

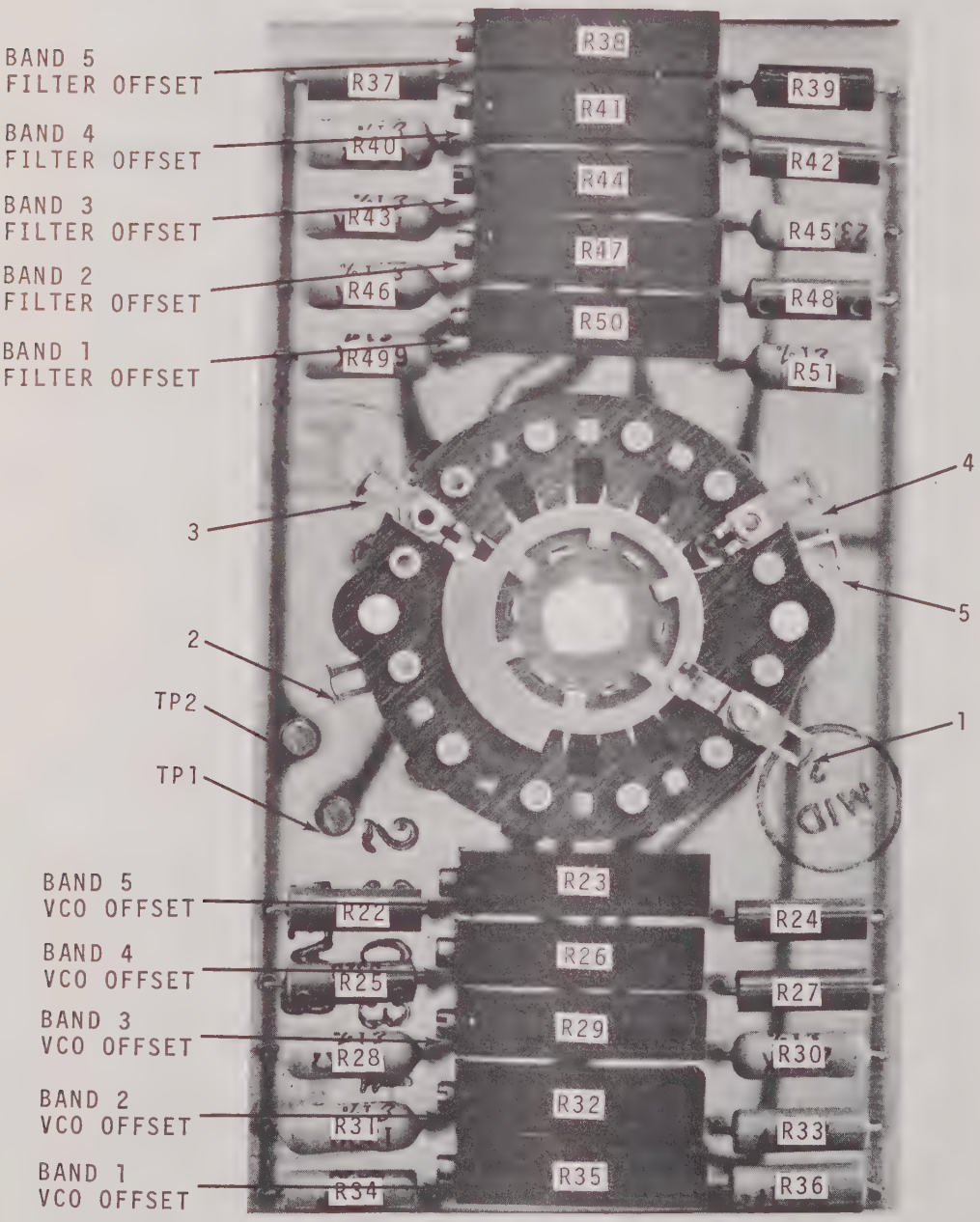


Figure 4-7. Switch S3 Deck 2--YIG Offset Board (230339)

SWITCH S3 DECK 2--YIG OFFSET BOARD (230339)

Item	Description	FMC	Part No.
R22	Resistor, 374, 1%, 1/8 W	81349	RN60C3740F
R23	Resistor, variable, 500	80294	3009P-1-501
R24	Resistor, 2.49 k, 1%, 1/8 W	81349	RN60C2491F
R25	Resistor, 374, 1%, 1/8 W	81349	RN60C3740F
R26	Resistor, variable, 500	80294	3009P-1-501
R27	Resistor, 2.49 k, 1%, 1/8 W	81349	RN60C2491F
R28	Resistor, 412, 1%, 1/8 W	81349	RN60C4120F
R29	Resistor, variable, 500	80294	3009P-1-501
R30	Resistor, 2.32 k, 1%, 1/8 W	81349	RN60C2321F
R31	Resistor, 130, 1%, 1/8 W	81349	RN60C1300F
R32	Resistor, variable, 500	80294	3009P-1-501
R33	Resistor, 2.61 k, 1%, 1/8 W	81349	RN60C2611F
R34	Resistor, 107, 1%, 1/8 W	81349	RN60C1070F
R35	Resistor, variable, 500	80294	3009P-1-501
R36	Resistor, 2.61 k, 1%, 1/8 W	81349	RN60C2611F
R37	Resistor, 681, 1%, 1/8 W	81349	RN60C6810F
R38	Resistor, variable, 500	80294	3009P-1-501
R39	Resistor, 3.01 k, 1%, 1/8 W	81349	RN60C3011F
R40	Resistor, 681, 1%, 1/8 W	81349	RN60C6810F
R41	Resistor, variable, 500	80294	3009P-1-501
R42	Resistor, 3.01 k, 1%, 1/8 W	81349	RN60C3011F
R43	Resistor, 1.82 k, 1%, 1/8 W	81349	RN60C1821F
R44	Resistor, variable, 500	80294	3009P-1-501
R45	Resistor, 2.32 k, 1%, 1/8 W	81349	RN60C2321F
R46	Resistor, 4.75 k, 1%, 1/8 W	81349	RN60C4751F
R47	Resistor, variable, 500	80294	3009P-1-501
R48	Resistor, 1.96 k, 1%, 1/8 W	81349	RN60C1961F
R49	Resistor, 6.81 k, 1%, 1/8 W	81349	RN60C6811F
R50	Resistor, variable, 500	80294	3009P-1-501
R51	Resistor, 1.96 k, 1%, 1/8 W	81349	RN60C1961F

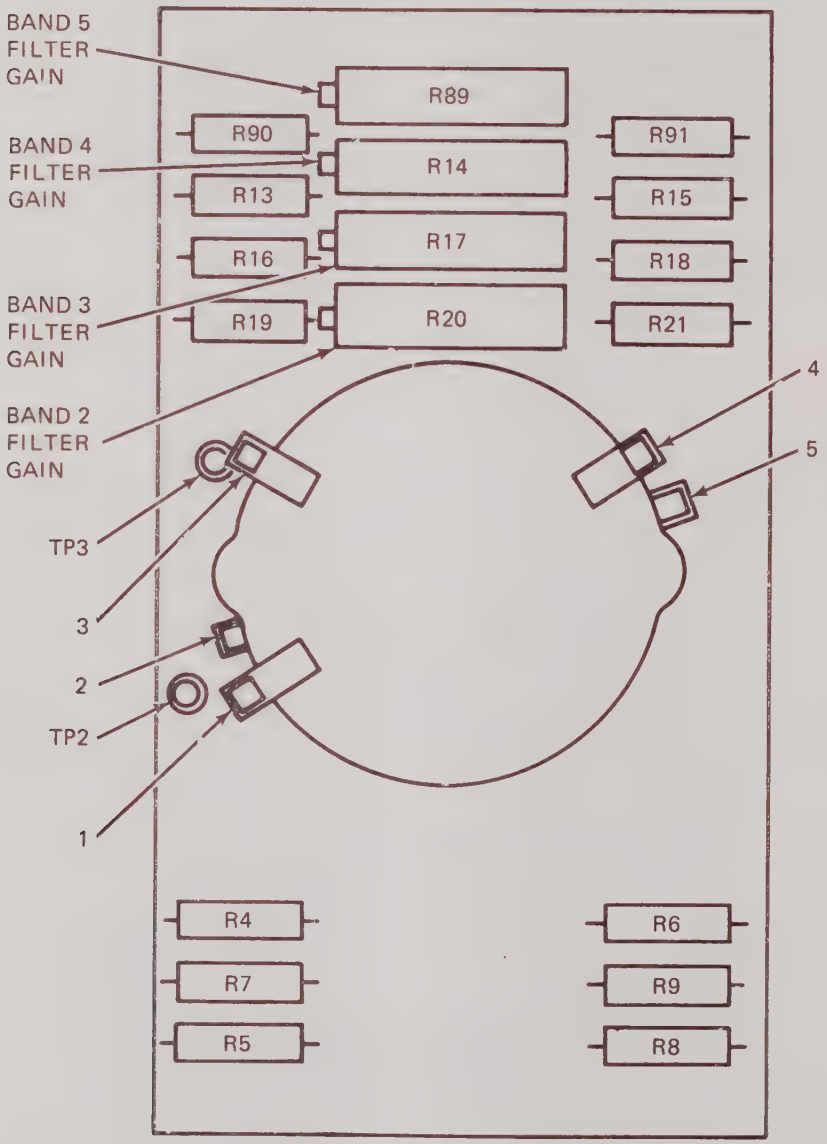


Figure 4-8. Switch S3 Deck 3--YIG Gains Board (299304)

SWITCH S3 DECK 3--YIG GAINS BOARD (299304)

Item	Description	FMC	Part No.
R1 thru	Not used		
R3	Not used		
R4, R5	Resistor, 2 k, 1%, 1/8 W	81349	RN60C2001F
R6 thru			
R9	Resistor, 1 k, 1%, 1/8 W	81349	RN60C1001F
R10 thru	Not used		
R12	Not used		
R13	Resistor, 3.01 k, 1%, 1/8 W	81349	RN60C3011F
R14	Resistor, variable, 500	80294	3009P-1-501
R15	Resistor, 1.78 k, 1%, 1/8 W	81349	RN60C1781F
R16	Resistor, 3.01 k, 1%, 1/8 W	81349	RN60C3011F
R17	Resistor, variable, 500	80294	3009P-1-501
R18	Resistor, 1.78 k, 1%, 1/8 W	81349	RN60C1781F
R19	Resistor, 30.1 k, 1%, 1/8 W	81349	RN60C3011F
R20	Resistor, variable, 500	80294	3009P-1-501
R21	Resistor, 1.78 k, 1%, 1/8 W	81349	RN60C1781F
R89	Resistor, variable, 500	80294	3009P-1-501
R90	Resistor, 3.01 k, 1%, 1/8 W	81349	RN60C3011F
R91	Resistor, 1.78 k, 1%, 1/8 W	81349	RN60C1781F

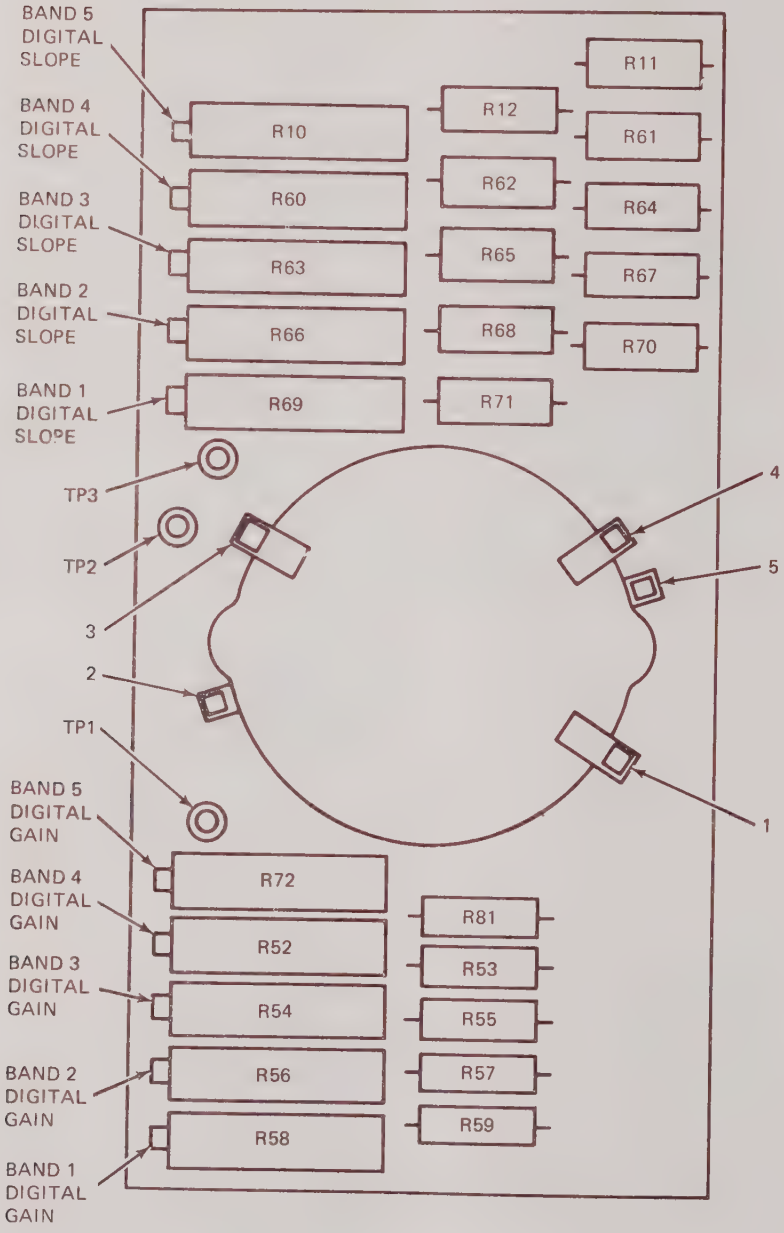


Figure 4-9. Switch S3 Deck 4--Digital Display Board (231028)

SWITCH S3 DECK 4--DIGITAL DISPLAY BOARD (231028)

Item	Description	FMC	Part No.
R10	Resistor, variable, 500	80294	3009P-1-501
R11	Resistor, 178 k, 1%, 1/8 W	81349	RN60C1783F
R12	Resistor, 3.65 k, 1%, 1/8 W	81349	RN60C3650F
R52	Resistor, variable, 2 k	80294	3009P-1-202
R53	Resistor, 5.11 k, 1%, 1/8 W	81349	RN60C5111F
R54	Resistor, variable, 5 k	80294	3009P-1-502
R55	Resistor, 9.31 k, 1%, 1/8 W	81349	RN60C9311F
R56	Resistor, variable, 10 k	80294	3009P-1-103
R57	Resistor, 7.5 k, 1%, 1/8 W	81349	RN60C7501F
R58	Resistor, variable, 10 k	80294	3009P-1-103
R59	Resistor, 22.1 k, 1%, 1/8 W	81349	RN60C2212F
R60	Resistor, variable, 500	80294	3009P-1-501
R61	Resistor, 113 k, 1%, 1/8 W	81349	RN60C1133F
R62	Resistor, 3.65 k, 1%, 1/8 W	81349	RN60C3651F
R63	Resistor, variable, 500	80294	3009P-1-501
R64	Resistor, 75 k, 1%, 1/8 W	81349	RN60C7502F
R65	Resistor, 3.65 k, 1%, 1/8 W	81349	RN60C3651F
R66	Resistor, variable, 500	80294	3009P-1-501
R67	Resistor, 53.6 k, 1%, 1/8 W	81349	RN60C5362F
R68	Resistor, 3.65 k, 1%, 1/8 W	81349	RN60C3651F
R69	Resistor, variable, 500	80294	3009P-1-501
R70	Resistor, 31.6 k, 1%, 1/8 W	81349	RN60C3162F
R71	Resistor, 3.65 k, 1%, 1/8 W	81349	RN60C3651F
R72	Resistor, variable	80294	3009P-1-202
R81	Resistor, 2.87 k, 1%, 1/8 W	81349	RN60C7871F

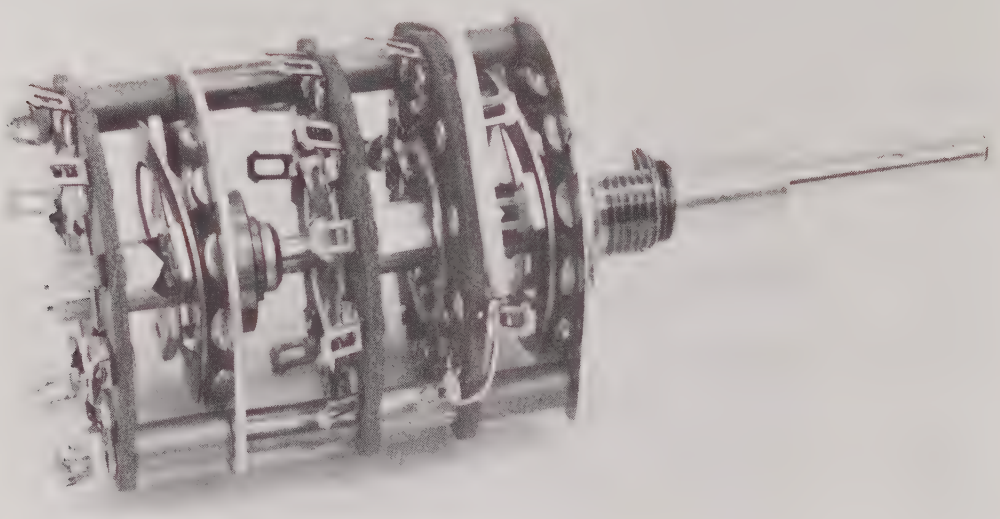


Figure 4-10. BANDWIDTH (kHz) Switch S4 (299477)

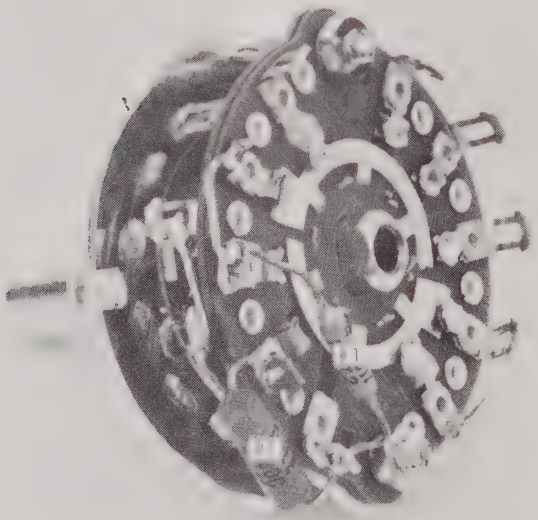


Figure 4-11. AMPLITUDE RANGE Switch S5 (299478)

Item	Description	FMC	Part No.
R1	Resistor, 45.3, 1/8 W	81349	RN60C45R3
R2	Resistor, 221, 1/8 W	81349	RN60C2210F

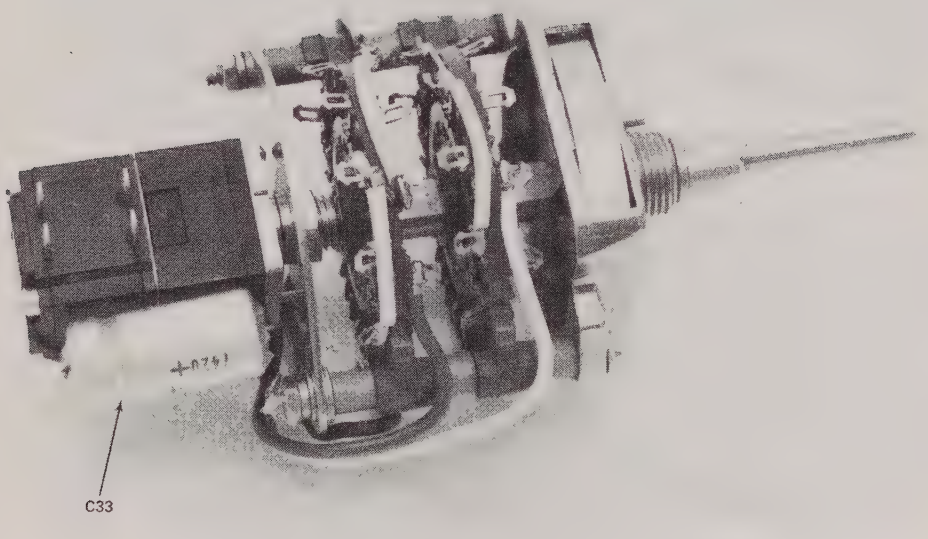


Figure 4-12. SCAN MODE Switch S6 (299479)

Item	Description	FMC	Part No.
C33	Capacitor, 430 μF, +8 V	25289	109D437X008T2

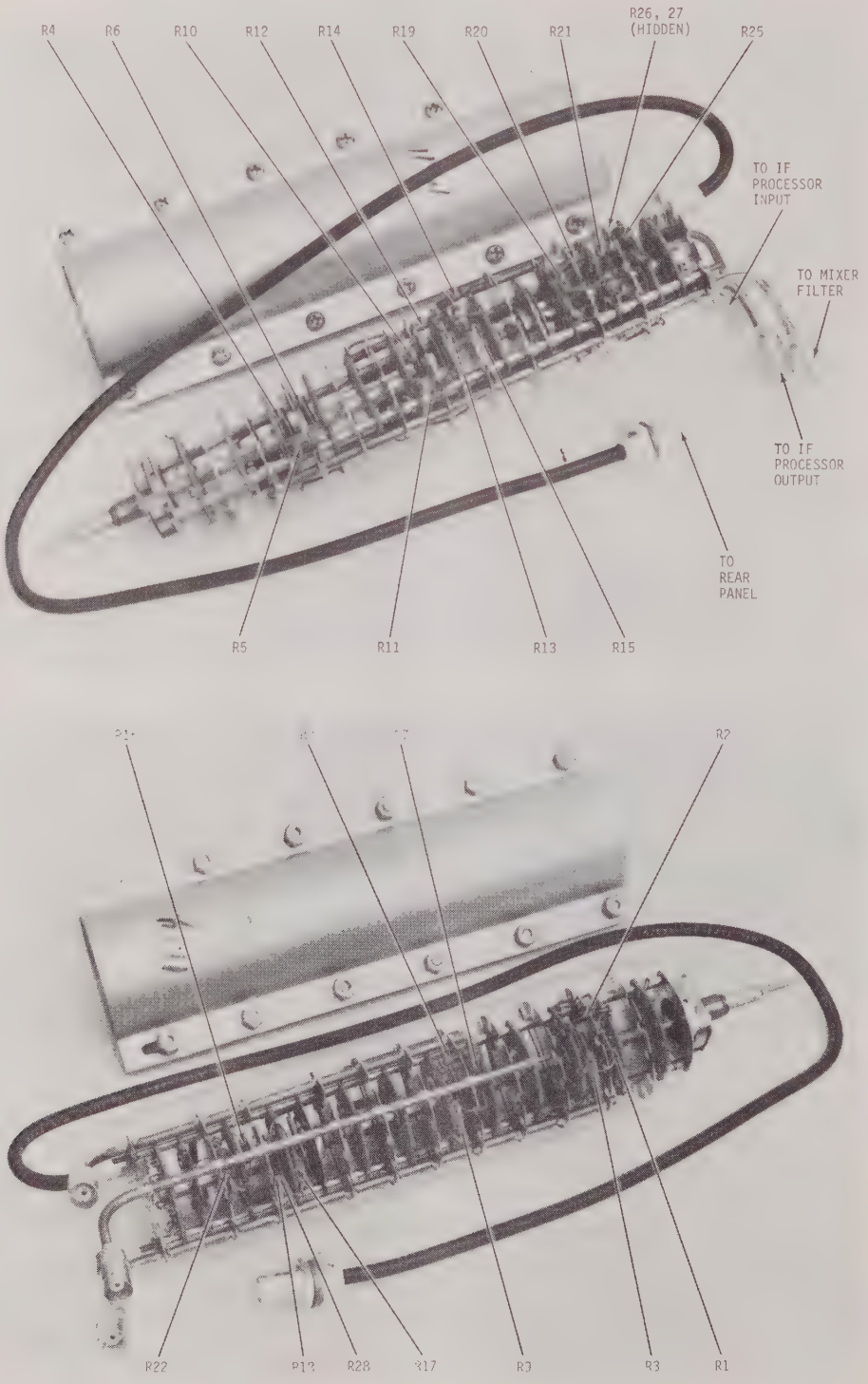
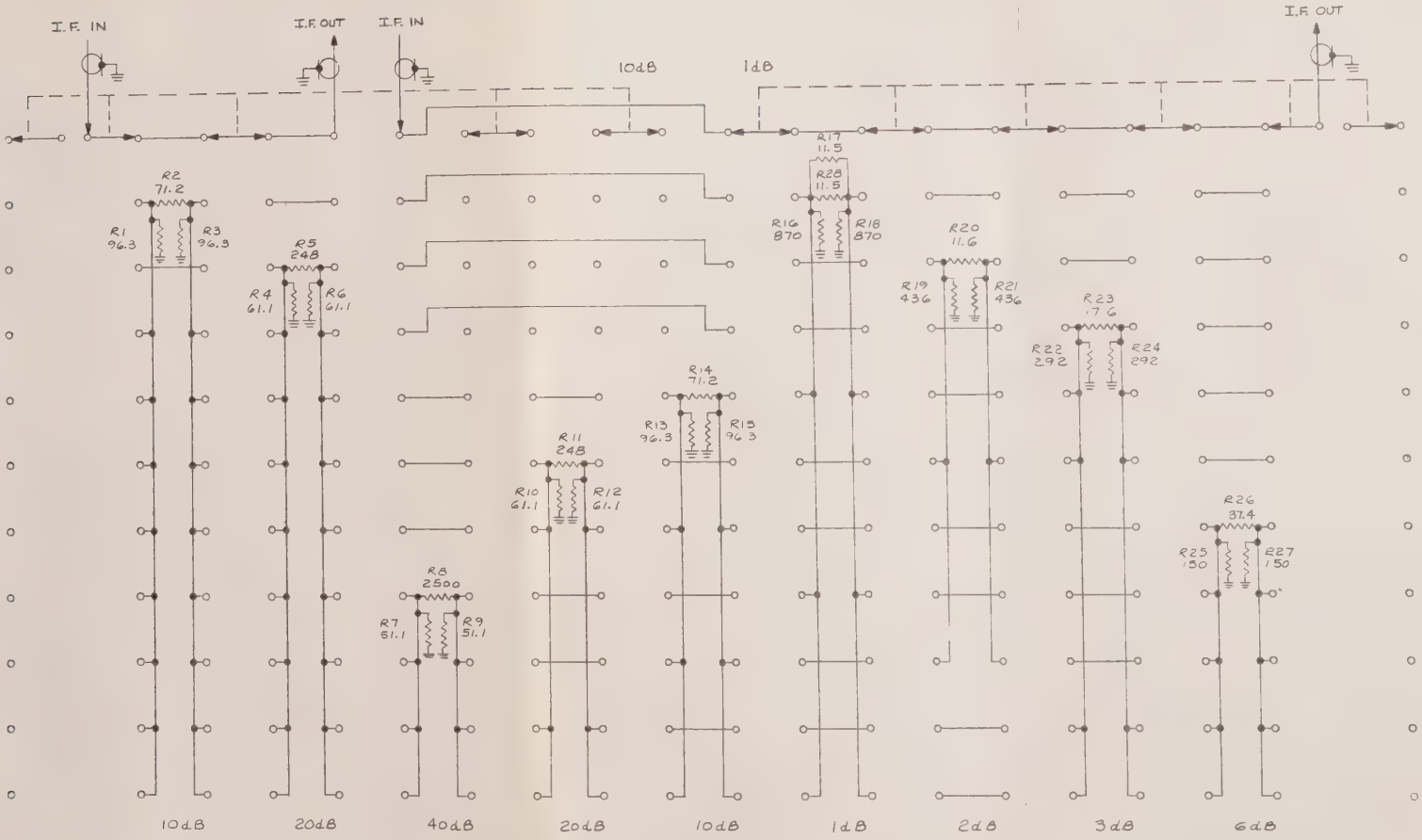


Figure 4-13. IF Attenuator Assembly (299367) (Sheet 1 of 2)



NOTE:
1 - ALL RESISTORS ARE RN60C, 1/2% TOL.

Figure 4-13. IF Attenuator Assembly (299367) (Sheet 2 of 2)

IF ATTENUATOR ASSEMBLY (299367)

Item	Description	FMC	Part No.
R1	Resistor, 96.3, 1/2%, 1/8 W	81349	RN60C96R3D
R2	Resistor, 71.2, 1/2%, 1/8 W	81349	RN60C71R2D
R3	Resistor, 96.3, 1/2%, 1/8 W	81349	RN60C96R3D
R4	Resistor, 61.1, 1/2%, 1/8 W	81349	RN60C61R1D
R5	Resistor, 248, 1/2%, 1/8 W	81349	RN60C2480D
R6	Resistor, 61.1, 1/2%, 1/8 W	81349	RN60C61R1D
R7	Resistor, 51.1, 1/2%, 1/8 W	81349	RN60C51R1D
R8	Resistor, 2500, 1/2%, 1/8 W	81349	RN60C2501D
R9	Resistor, 51.1, 1/2%, 1/8 W	81349	RN60C51R1D
R10	Resistor, 61,1, 1/2%, 1/8 W	81349	RN60C61R1D
R11	Resistor, 248, 1/2%, 1/8 W	81349	RN60C2480D
R12	Resistor, 61.1, 1/2%, 1/8 W	81349	RN60C61R1D
R13	Resistor, 96.3, 1/2%, 1/8 W	81349	RN60C96R3D
R14	Resistor, 71.2, 1/2%, 1/8 W	81349	RN60C71R2D
R15	Resistor, 96.3, 1/2%, 1/8 W	81349	RN60C96R3D
R16	Resistor, 870, 1/2%, 1/8 W	81349	RN60C8700D
R17	Resistor, 11.5, 1/2%, 1/8 W	81349	RN60C11R5D
R18	Resistor, 870, 1/2%, 1/8 W	81349	RN60C8700D
R19	Resistor, 436, 1/2%, 1/8 W	81349	RN60C4360D
R20	Resistor, 11.6, 1/2%, 1/8 W	81349	RN60C11R6D
R21	Resistor, 436, 1/2%, 1/8 W	81349	RN60C4360D
R22	Resistor, 292, 1/2%, 1/8 W	81349	RN60C2920D
R23	Resistor, 17.6, 1/2%, 1/8 W	81349	RN60C17R6D
R24	Resistor, 292, 1/2%, 1/8 W	81349	RN60C2920D
R25	Resistor, 150, 1/2%, 1/8 W	81349	RN60C1500D
R26	Resistor, 37.4, 1/2%, 1/8 W	81349	RN60C37R4D
R27	Resistor, 150, 1/2%, 1/8 W	81349	RN60C1500D
R28	Resistor, 11.5, 1/2%, 1/8 W	81349	RN60C11R5D

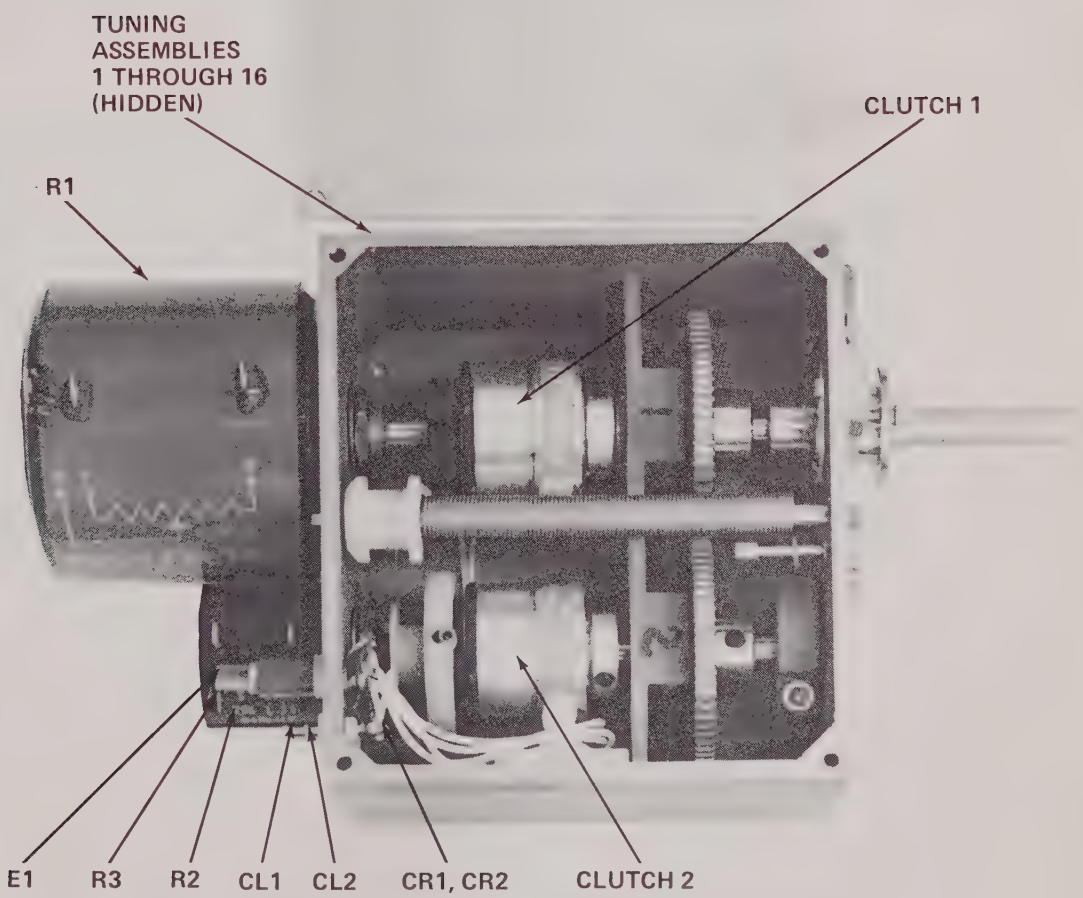


Figure 4-14. Tuner Assembly (299137)

TUNER ASSEMBLY (299137)

Item	Description	FMC	Part No.
C1	Capacitor, 430 μF	56289	109D437X0008T2
C2, C3	Capacitor, 100 μF, 25 V	56289	TE-1211
C4	Capacitor, 430 μF	56289	109D437X0008T2
CR1, CR2	Diode	81349	1N4009
R1	Resistor, variable	80294	3400S-1-502
R2	Resistor, variable	05725	8136-SK
R3	Not used		
R4, R5	Resistor, 56, 0.5 W	81349	RC20GF560J
R6	Resistor, 5.1 k, 1/4 W	81349	RC07GF512J
	Clutch	05420	FG08-04-04-5-014
	Nylon, 12 lb test, 0.13 dia	---	---

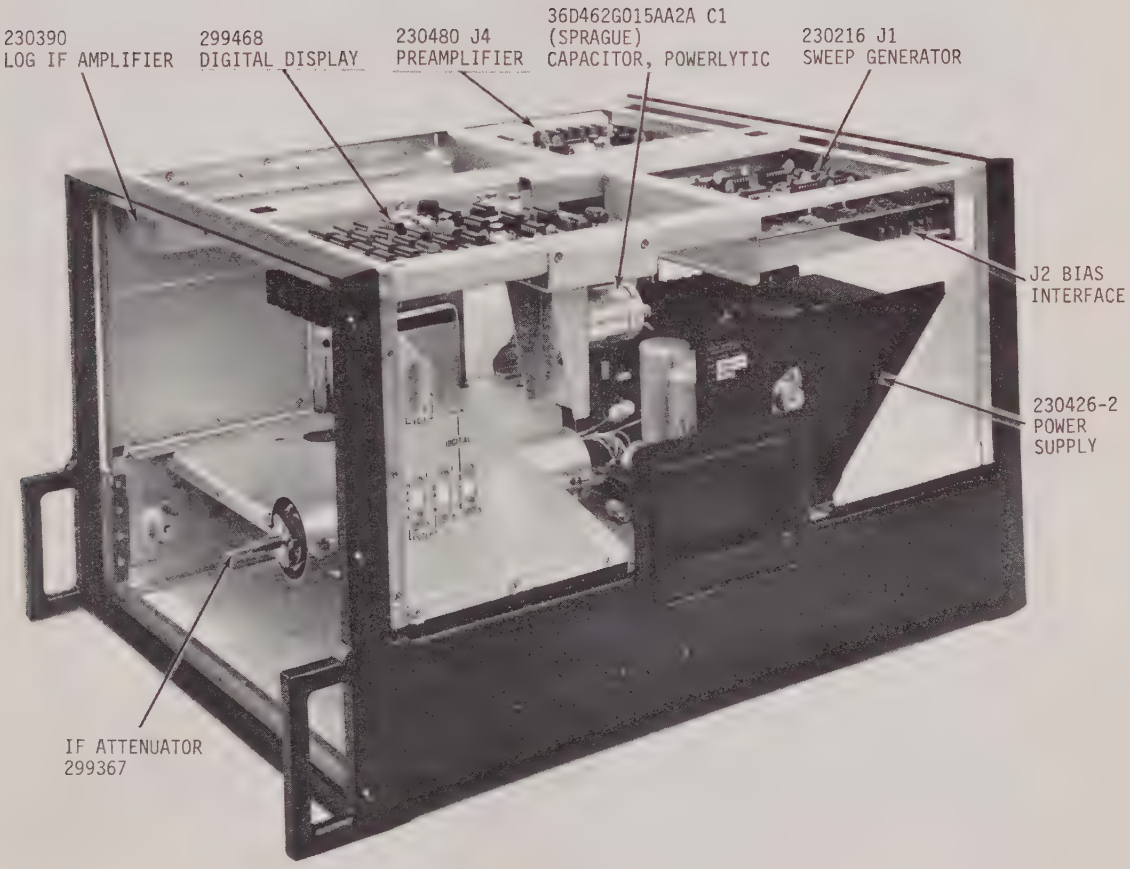


Figure 4-15. Main Frame Assembly

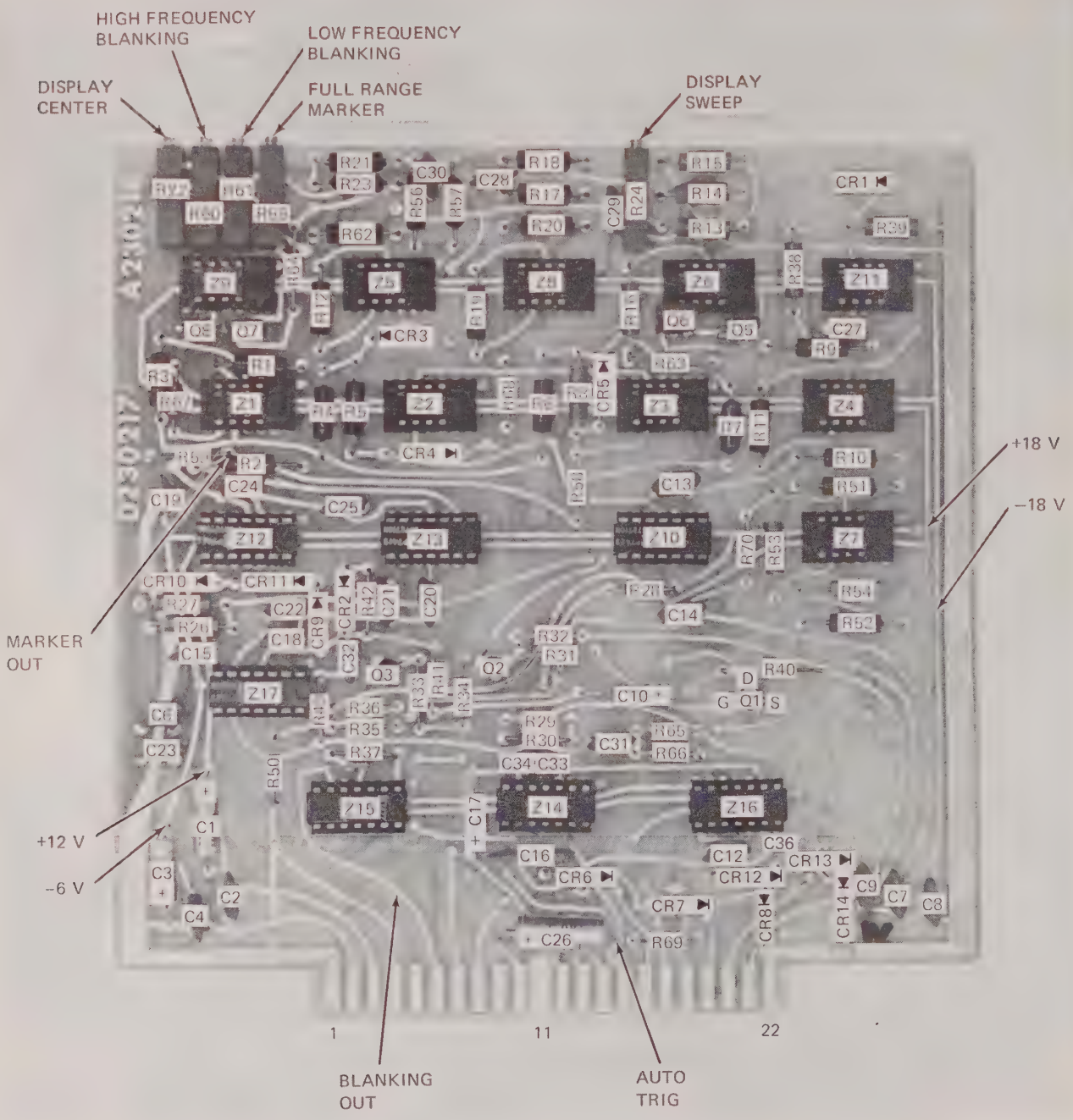
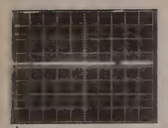
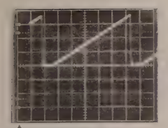


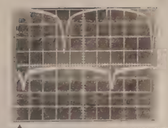
Figure 4-16. Sweep Generator J1 Board (230216) (Sheet 1 of 2)



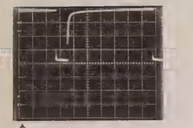
J1 PIN 6 - BLANKING
1 V/cm
5 ms/cm
200 MHz/div
Fo = 3 GHz



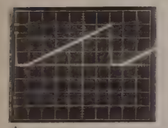
J1 PIN 13 - DISPLAY SWEEP
0.5 V/cm
5 ms/cm
(FUNCTION OF CONTROL SETTINGS)



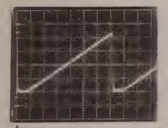
J1 PIN 14 - FULL RANGE MARKER OUTPUT
100 mV/cm
5 ms/cm
AC COUPLED
UPPER TRACE: FULL RANGE SWITCH OFF
LOWER TRACE: FULL RANGE SWITCH ON



J1 PIN 16 - RETRACE
1 V/cm
5 ms/cm

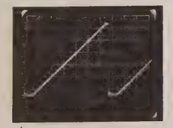


J1 PIN 21 - SWEEP OUTPUT
2 V/cm
5 ms/cm



J3 PIN R - RIG SWEEP
2 V/cm
5 ms/cm
200 MHz/cm
BAND CENTER

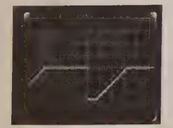
J1 PIN U - LCVCO SWEEP
2 V/cm
5 ms/cm
300 kHz/div
Fo = 3 GHz



J1 PIN D - SCAN SWEEP
5 V/cm
5 ms/cm
200 MHz/div

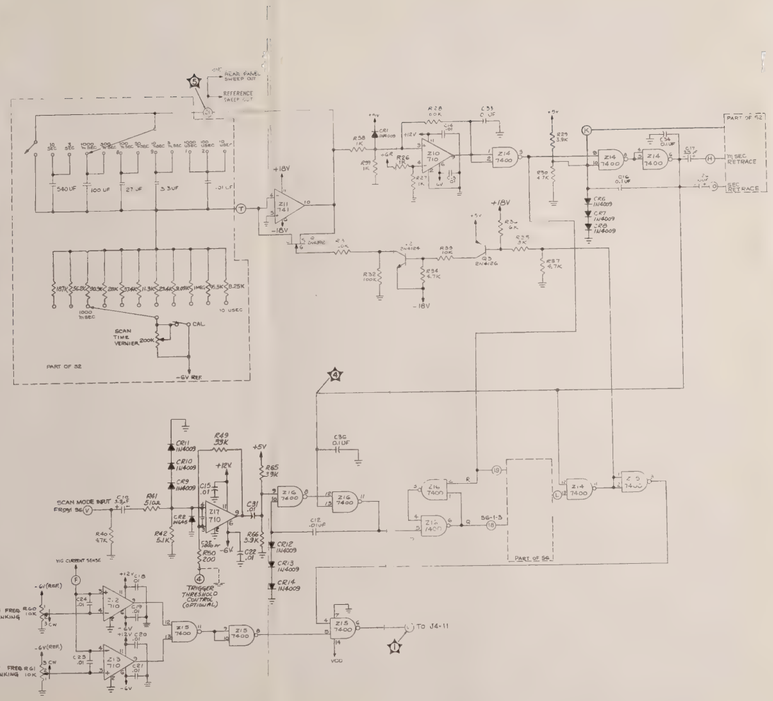
J1 PIN 15
0.5 V/cm
200 MHz/div
Fo = 3 GHz

J1 PIN L
1 V/cm
5 ms/cm
AUTO SYNC
3 msec/div SCAN TIME



J1 - CR4 ANODE
FULL RANGE BAND 2
1 V/cm
5 ms/cm

NOTE: CENTER GRATICULE IS ZERO VOLTS UNLESS OTHERWISE SPECIFIED.



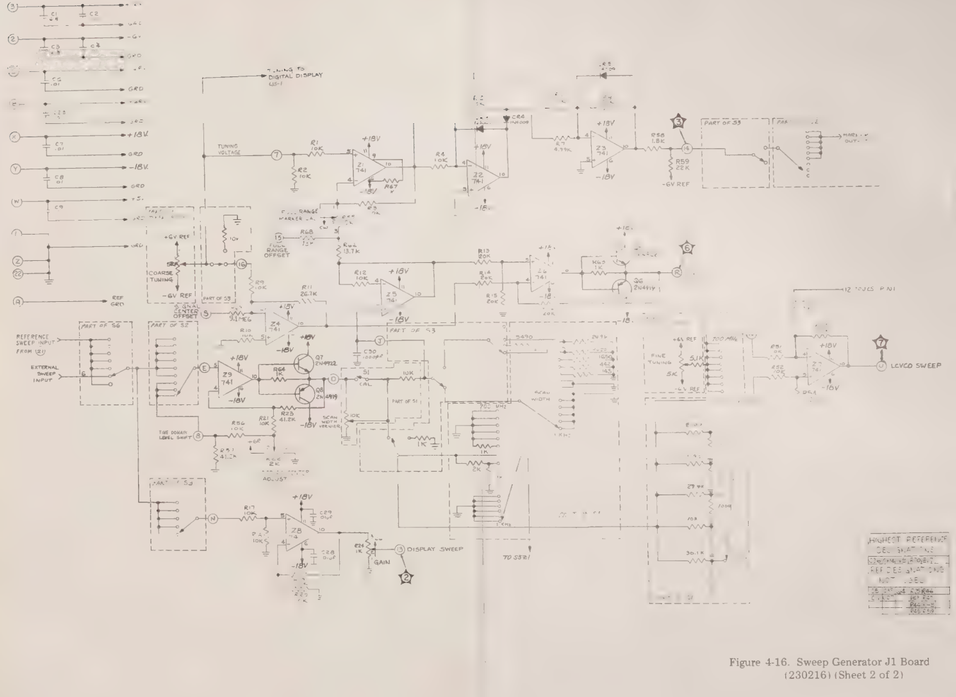


Figure 4-16. Sweep Generator J1 Board (230216) (Sheet 2 of 2)

SWEEP GENERATOR J1 BOARD (230216)

Item	Description	FMC	Part No.
C1	Capacitor, 6.8 μF	81349	CS13BF685M
C2	Capacitor, .01 μF	56289	5HKS-S10
C3	Capacitor, 6.8 μF	81349	CS13BF685M
C4	Capacitor, .01 μF	56289	5HKS-S10
C5	Not used		
C6 thru C9	Capacitor, 0.01 μF	56289	5HKS-S10
C10	Capacitor, 3.3 μF	81349	CS13BD335K
C11	Not used		
C12 thru C15	Capacitor, 0.01 μF	56289	5HKS-S10
C16	Capacitor, 0.1 μF, 75 V	71590	DDA-104
C17	Capacitor, 3.3 μF	81349	CS13BD335K
C18 thru C25	Capacitor, 0.01 μF	56289	5HKS-S10
C26	Capacitor, 100 μF	56289	CS13BC107K
C27	Capacitor, 0.01 μF	81349	CK05BX103K
C28, C29	Capacitor, 0.01 μF	56289	5HKS-S10
C30	Capacitor, 1000 pf	71590	DD-102G
C31	Capacitor, 0.01 μF	56289	5HKS-S10
C32	Capacitor, 1000 pf	71590	DD-102G
C33, C34	Capacitor, 0.1 μF	00752	299245-1
C35	Not used		
C36	Capacitor, 0.1 μF	00752	299245-1
CR1	Diode	03508	1N4009
CR2	Diode	03508	1N645
CR3 thru CR14	Diode	03508	1N4009
Q1	Transistor	04713	2N4392
Q2	Transistor	04713	2N4124
Q3	Transistor	49956	2N4126
Q4	Not used		
Q5	Transistor	49956	2N4922
Q6	Transistor	04713	2N4919
Q7	Transistor	49956	2N4922
Q8	Transistor	04713	2N4919
R1 thru R6	Resistor, 10 k, 1/8 W	81349	RN60C1002F
R7	Resistor, 4.99 k, 1/8 W	81349	RN60C4991F
R8	Resistor, 20 k, 1/8 W	81349	RN60C2002F
R9, R10	Resistor, 10 k, 1/8 W	81349	RN60C1002F
R11	Resistor, 26.7 k, 1/8 W	81349	RN60C2672F
R12	Resistor, 10 k, 1/8 W	81349	RN60C1002F
R13 thru R16	Resistor, 20 k, 1/8 W	81349	RN60C2002F
R17 thru R21	Resistor, 10 k, 1/8 W	81349	RN60C1002F
R22	Resistor, variable, 2 k	80294	3009P-1-202
R23	Resistor, 41.2 k, 1/8 W	81349	RN60C4122F
R24	Resistor, variable, 1 k	80294	3009P-1-102
R25	Not used		
R26, R27	Resistor, 1 k, 1/8 W	81349	RN60C1001F

SWEEP GENERATOR J1 BOARD (230216) (cont)

Item	Description	FMC	Part No.
R28	Resistor, 100 k, 1/4 W	81349	RC07GF104J
R29	Resistor, 3.9 k, 1/4 W	81349	RC07GF392J
R30	Resistor, 4.7 k, 1/4 W	81349	RC07GF472J
R31, R32	Resistor, 100 k, 1/4 W	81349	RC07GF104J
R33	Resistor, 10 k, 1/4 W	81349	RC07GF103J
R34	Resistor, 4.7 k, 1/4 W	81349	RC07GF472J
R35	Resistor, 3 k, 1/4 W	81349	RC07GF302J
R36	Resistor, 16 k, 1/4 W	81349	RC07GF163J
R37	Resistor, 4.7 k, 1/4 W	81349	RC07GF472J
R38, R39	Resistor, 1 k, 1/8 W	81349	RN60C1001F
R40	Resistor, 4.7 k, 1/4 W	81349	RC07GF472J
R41	Resistor, 510, 1/4 W	81349	RC07GF511J
R42	Resistor, 5.1 k, 1/4 W	81349	RC07GF512J
R43 thru R48	Not used		
R49	Resistor, 33 k, 1/4 W	81349	RC07GF333J
R50	Resistor, 200, 1/4 W	81349	RC07GF201J
R51, R52	Resistor, 10 k, 1/8 W	81349	RN60C1002F
R53	Resistor, 20 k, 1/8 W	81349	RN60C2002F
R54	Resistor, 1.21 k, 1/8 W	81349	RN60C1211F
R55	Resistor, variable, 5 k	80294	3009P-1-502
R56	Resistor, 10 k, 1/8 W	81349	RN60C1002F
R57	Resistor, 41.2 k, 1/8 W	81349	RN60C4122F
R58	Resistor, 4.3 k, 1/4 W	81349	RC07GF432J
R59	Resistor, 7.5 k, 1/4 W	81349	RC07GF752J
R60, R61	Resistor, variable, 10 k	80294	3009P-1-103
R62	Resistor, 13.7 k, 1/8 W	81349	RN60C1372F
R63, R64	Resistor, 1 k, 1/4 W	81349	RC07GF102J
R65, R66	Resistor, 3.9 k, 1/4 W	81349	RC07GF392J
R67	Resistor, 1 k, 1/4 W	81349	RC07GF102J
R68	Resistor, 13 k, 1/4 W	81349	RC07GF133J
R69	Resistor, 9.1 Meg, 1/4 W	81349	RC07GF915J
R70	Resistor, 1 k, 1/4W	81349	RC07GF102J
Z1 thru Z9	IC	01295	SN72741P
Z10	IC	01295	SN72710N
Z11	IC	01295	SN72741P
Z12, Z13	IC	01295	SN72710N
Z14 thru Z16	IC	01295	SN7400N
Z17	IC	01295	SN72710N

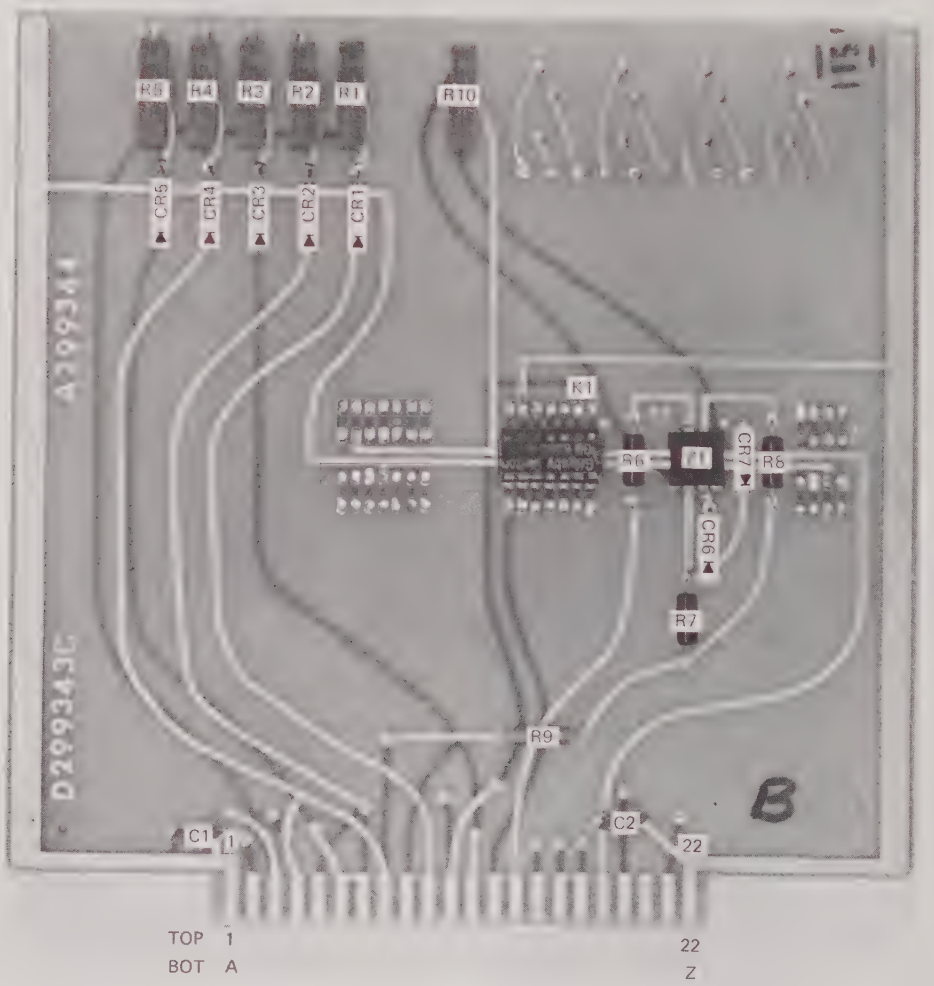


Figure 4-17. Bias Interface J2 Board (299334) (Sheet 1 of 2)

BIAS INTERFACE J2 BOARD (299334)

Item	Description	FMC	Part No.
C1, C2	Capacitor, .01 μF	56289	5HKS-S10
CR1 thru CR7	Diode	03508	1N4009
K1	Relay	24211	GB835C-6
R1 thru R5	Resistor, variable, 10 k	80294	3009-P-1-103
R6 thru R8	Resistor, 1 k, 1%	81349	RN60C1001F
R9	Resistor, 200, 1%	81349	RN60C2000F
R10	Resistor, variable, 10 k	80294	3009-P-1-103
Z1	Integrated circuit	01295	SN72741

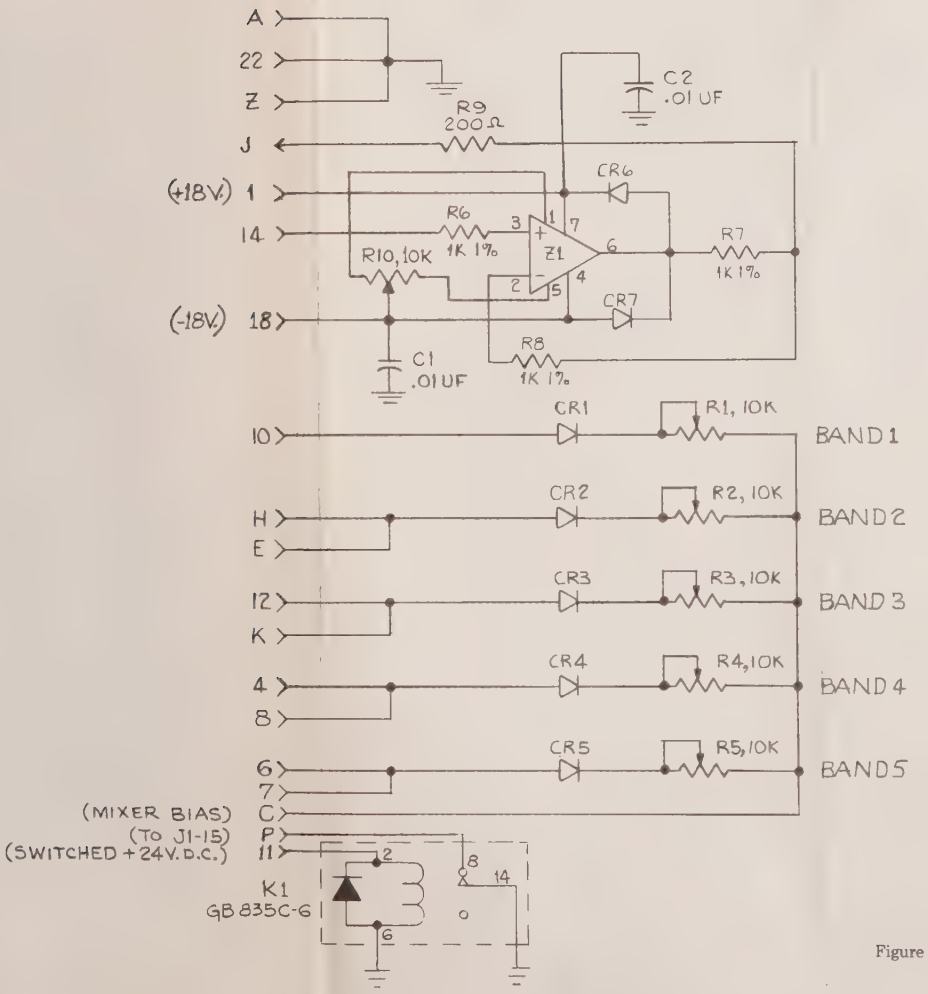


Figure 4-17. Bias Interface J2 Board (299334)
(Sheet 2 of 2)

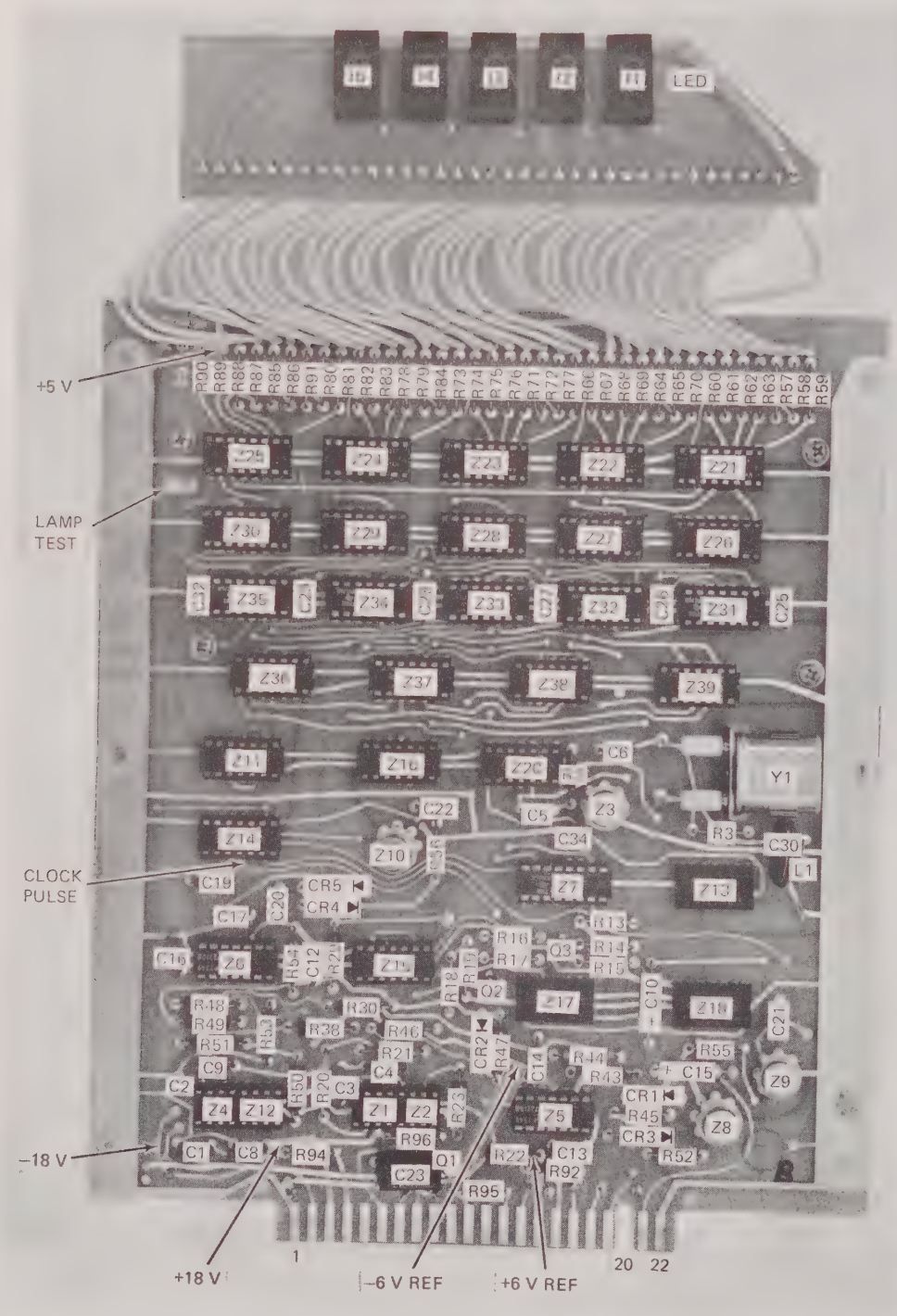
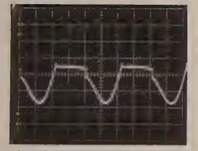


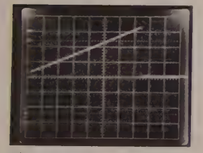
Figure 4-18. Digital Display J3 Board (299468) (Sheet 1 of 2)

1 J3 BETWEEN CAPACITOR C6 AND CRYSTAL Y1
1 V/cm
1 µs/cm

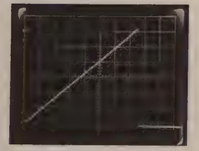


2 J3 Z3 PIN 5
2 V/cm
1 µs/cm

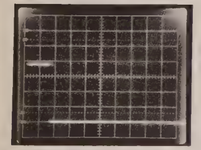
3 J3- Z14-4, 5
1 V/cm
5 ms/cm



4 J3 - Z1-6
5 V/cm
2 ms/cm



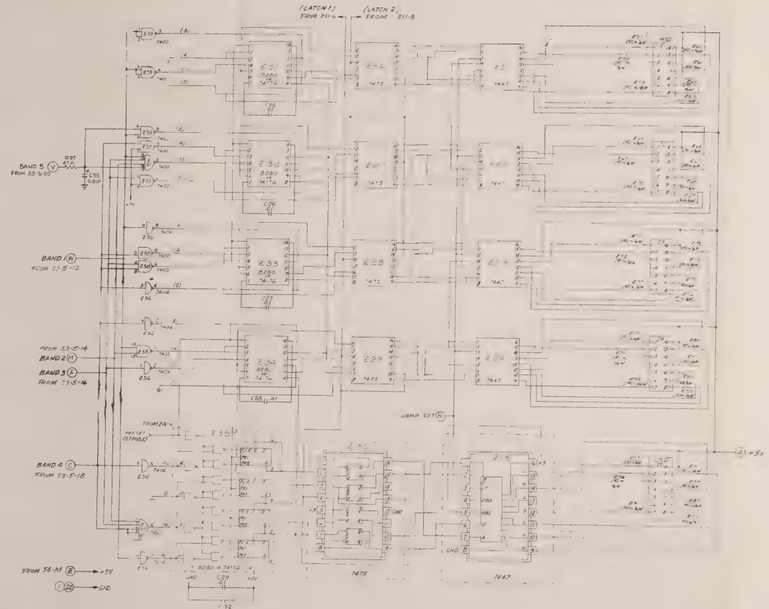
5 J3 - Z2-6
5 V/cm
2 ms/cm



6 J3 - Q3 COLLECTOR
5 V/cm
10 ms/cm

NOTE: CENTER GRATICULE IS ZERO VOLTS UNLESS OTHERWISE SPECIFIED.

PRESETS	BAND
94848	1
1044	2
3114	3
4785	4
9000	5



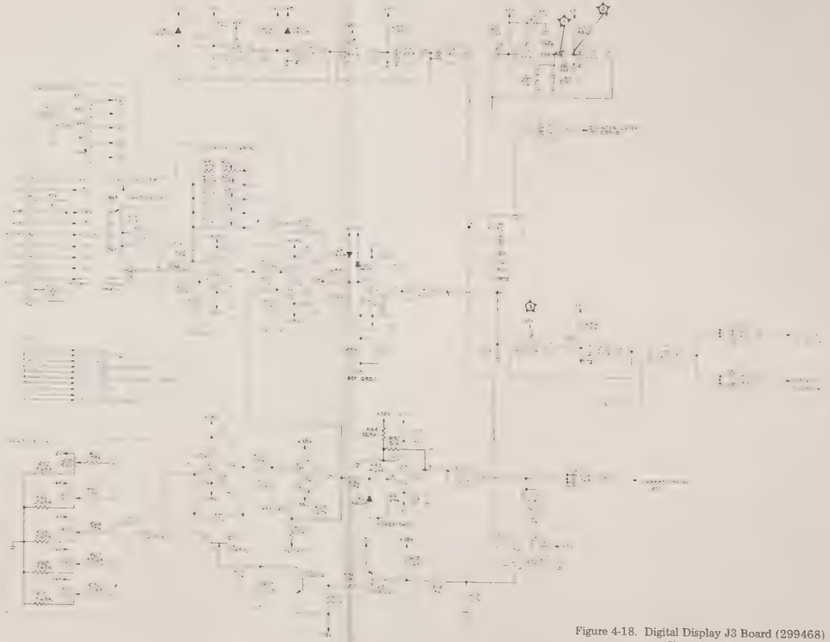


Figure 4-18. Digital Display J3 Board (299468) (Sheet 2 of 2)

DIGITAL DISPLAY J3 BOARD (299468)

Item	Description	FMC	Part No.
C1 thru C4	Capacitor, 0.01 μF	56289	5HKS-S10
C5	Capacitor, 820 pF	71590	DD-821
C6	Capacitor, 3000 pF	71590	DD-302
C7	Not used		
C8, C9	Capacitor, 0.01 μF	56289	5HKS-S10
C10	Capacitor, 27 μF	81349	CS13BC276K
C11	Not used		
C12 thru C14	Capacitor, 0.01 μF	56289	5HKS-S10
C15	Capacitor, 27 μF	81349	CS13BC276K
C16, C17	Capacitor, 0.01 μF	56289	5HKS-S10
C18	Not used		
C19 thru C22	Capacitor, 0.01 μF	56289	5HKS-S10
C23	Capacitor, 0.1 μF, ±2%, 100 V	50930	K119Z-13±2%
C24	Not used		
C25 thru C29	Capacitor, 0.01 μF	56289	5HKS-S10
C30	Capacitor, 1500 pF	81349	CM06FD153J03
C31	Not used		
C32	Capacitor, 0.01 μF	56289	5HKS-S10
C33	Not used		
C34, C35	Capacitor, 6.8 μF	00752	299420-1
CR1 thru CR5	Diode	80131	1N4009
I1 thru I5	Led, readout	50436	5082-7730
L1	Coil, 270 μH	71895	1025-78
Q1	Transistor	04713	2N4392
Q2	Transistor	04713	2N4124
Q3	Transistor	49956	2N4126
R1	Not used		
R2	Resistor, 56 k, 1/4 W	81349	RC07GF563J
R3	Resistor, 33 k, 1/4 W	81349	RC07GF333J
R4 thru R12	Not used		
R13	Resistor, 47 k, 1/4 W	81349	RC07GF473J
R14	Resistor, 3 k, 1/4 W	81349	RC07GF302J
R15	Resistor, 16 k, 1/4 W	81349	RC07GF163J
R16	Resistor, 10 k, 1/4 W	81349	RC07GF103J
R17	Resistor, 47 k, 1/4 W	81349	RC07GF473J
R18, R19	Resistor, 100 k, 1/4 W	81349	RC07GF104J
R20	Resistor, 13.3 k, 1/8 W	81349	RC60C1332F
R21	Resistor, 16.2 k, 1/8 W	81349	RN60C1622G
R22	Resistor, 10 k, 1/8 W	81349	RN60C1002F
R23	Resistor, 26.7 k, 1/8 W	81349	RN60C2672F
R24 thru R28	Not used		
R29, R30	Resistor, 20 k, 1/8 W	81349	RN60C2002F
R31 thru R37	Not used		
R38	Resistor, 1.5 k, 1/8 W	81349	RN60C1501F
R39 thru R42	Not used		
R43	Resistor, 4.64 k, 1/8 W	81349	RN60C4641F

DIGITAL DISPLAY J3 BOARD (299468) (cont)

Item	Description	FMC	Part No.
R44	Resistor, 16.5 k, 1/8 W	81349	RN60C1652F
R45	Resistor, 15 k, 1/4 W	81349	RC07GF153J
R46	Resistor, 15 k, 1/8 W	81349	RC60C1502F
R47	Resistor, 4.99 k, 1/8 W	81349	RN60C4991F
R48, R49	Resistor, 10 k, 1/8 W	81349	RN60C1002F
R50	Resistor, 9.09 k, 1/8 W	81349	RN60C9091F
R51	Resistor, 10 k, 1/8 W	81349	RN60C1002F
R52	Resistor, 15 k, 1/4 W	81349	RC07GF153J
R53, R54	Resistor, 100, 1/8 W	81349	RN60C1000F
R55	Resistor, 2.4 k, 1/4 W	81349	RC07GF242J
R56	Resistor, 1.5 k, 1/4 W	81349	RC07GF152J
R57 thru R91	Resistor, 240, 1/4 W	81349	RC07GF241J
R92	Resistor, 51 k, 1/4 W	81349	RC07GF513J
R93	Resistor, 100 k, 1/4 W	81349	RC07GF104J
R94	Resistor, 18 Meg, 1/4 W	81349	RC07GF186J
R95	Resistor, 1.5 k, 1/4 W	81349	RC07GF152J
R96	Resistor, 1 k, 1/4 W	81349	RC07GF102J
R97	Resistor, 47, 1/4 W	81349	RC07GF470J
Y1	Crystal, 250 kHz	00752	230479-5
Z1, Z2	IC	01295	SN72741P
Z3	IC	07263	U5B991429
Z4	IC	01295	SN72741P
Z5, Z6	IC	01295	SN72710N
Z7	IC	01295	SN7476N
Z8 thru Z10	IC	07263	U5B991429
Z11	IC	01295	SN7440N
Z12	IC	01295	SN72741P
Z13	Not used		
Z14, Z15	IC	01295	SN7400N
Z16	IC	01295	SN7440N
Z17 thru Z19	Not used		
Z20	IC	01295	SN7400N
Z21 thru Z25	IC	01295	SN7447N
Z26 thru Z30	IC	01295	SN7475N
Z31 thru Z35	IC	01295	SN74176N
Z36	IC	01295	SN7404N
Z37	IC	01295	SN7420N
Z38, Z39	IC	01295	SN7400N

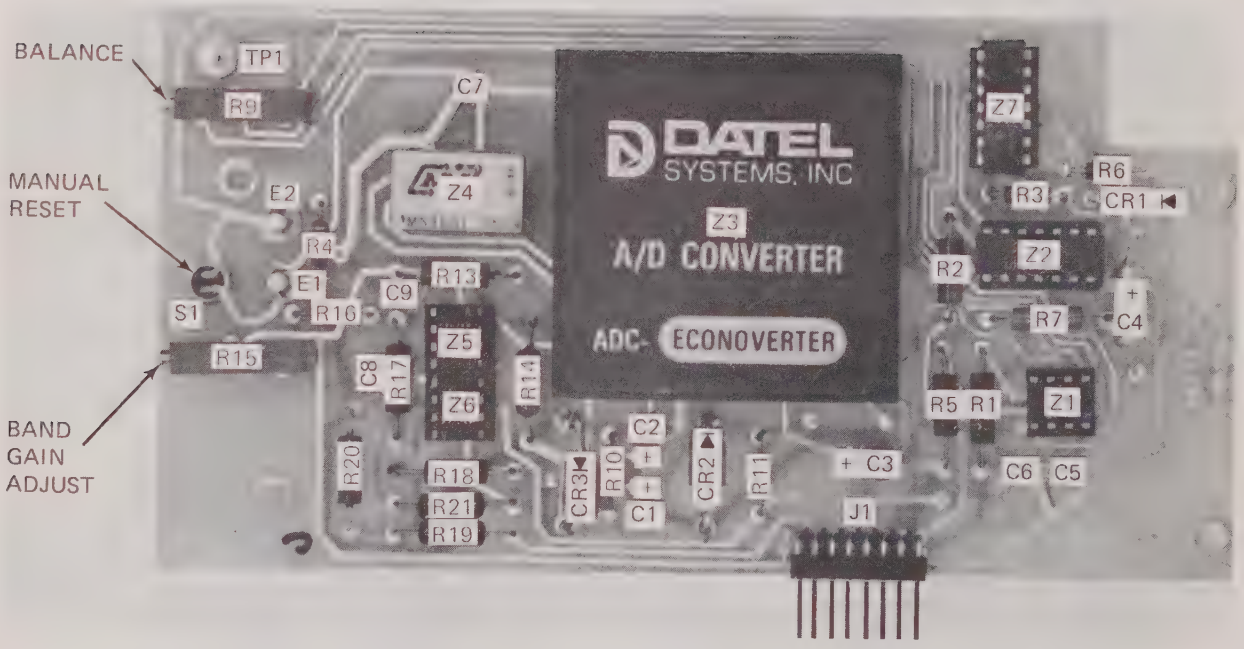
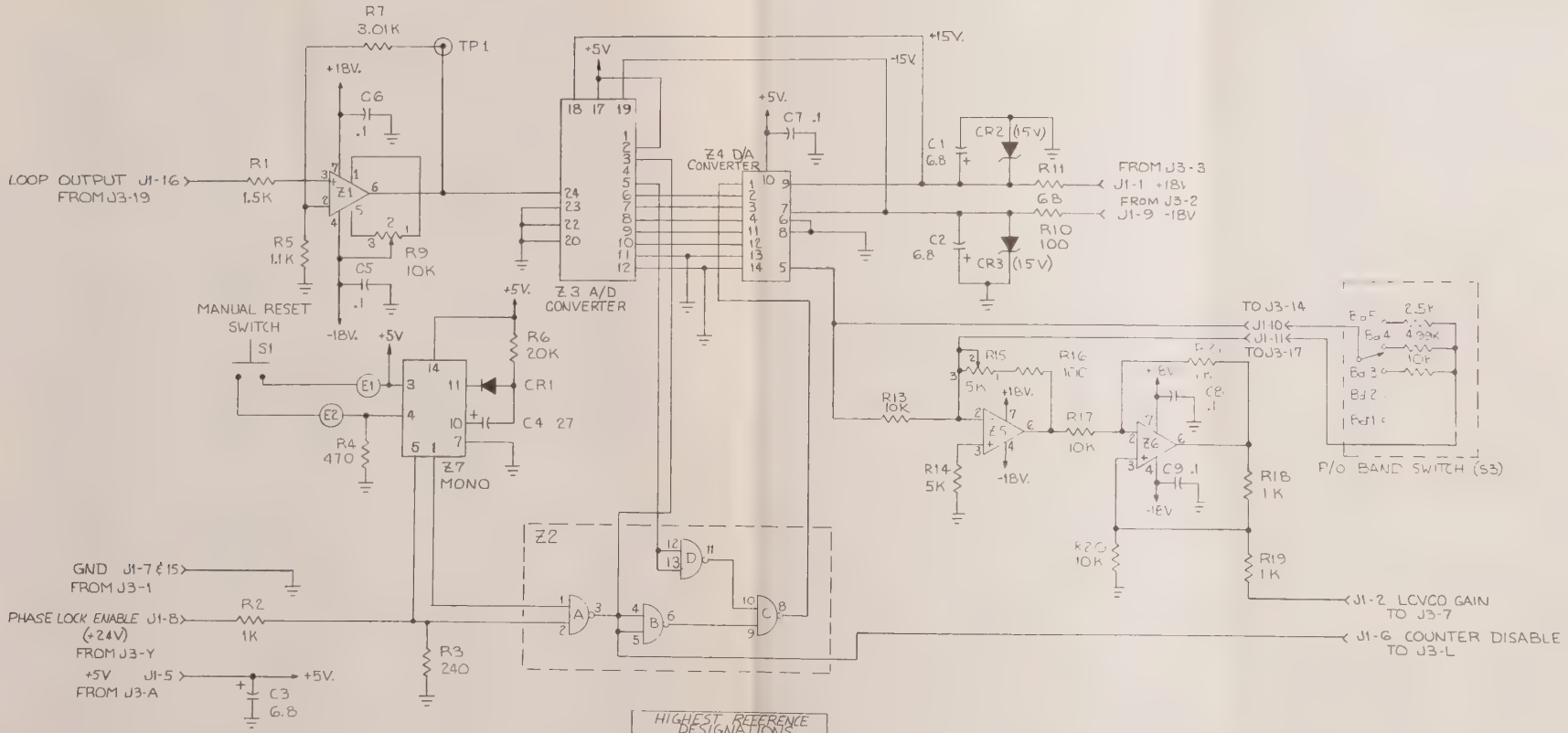


Figure 4-19. Auto Centering Board (299378)



HIGHEST REFERENCE DESIGNATIONS			
R21	C9	CR3	Z7
REFERENCE DESIGNATIONS NOT USED			
R8, R12			

NOTES:
1. Z1, Z5 & Z6 – N5741V, Z2 – SN7400N, Z7 – SN74121N.
   CR1 – IN4009
   CR2, CR3 – 3024B.
2. ON Z2 – PIN 7 IS GND, PIN 14 IS +5V.
3. UNLESS OTHERWISE SPECIFIED
   ALL CAPACITORS ARE IN UFD.,
   AND RESISTORS ARE IN Ω.

Figure 4-19. Auto Centering Board (299378)
(Sheet 2 of 2)

AUTO CENTERING BOARD (299378)

Item	Description	FMC	Part No.
C1 thru C3	Capacitor, electrolytic, 6.8 μF	00752	299240-1
C4	Capacitor, electrolytic, 27 μF		13BC276K
C5 thru C9	Capacitor, .1 μF	00752	299245-1
CR1	Diode	03508	1N4009
CR2, CR2	Diode, zener	03508	1N3024B
R1	Resistor, 1.5 k, 1/8 W, 1%	81349	RN60C1501F
R2	Resistor, 1 k, 1/2 W, 5%	81349	RC20GF102J
R3	Resistor, 240, 1/4 W, 5%	81349	RC07GF241J
R4	Resistor, 470, 1/4 W, 5%	81349	RC07GF471J
R5	Resistor, 1.1 k, 1/8 W, 1%	81349	RN60C1101F
R6	Resistor, 20 k, 1/4 W, 5%	81349	RC07GF203J
R7	Resistor, 3.01 k, 1/8 W, 1%	81349	RN60C3011F
R8	Not used		
R9	Resistor, variable, 10 k	80294	3009P-1-103
R10	Resistor, 100, 1/4 W, 5%	81349	RC07GF101J
R11	Resistor, 68, 1/4 W, 5%	81349	RC07GF680J
R12	Not used		
R13	Resistor, 10 k, 1/8 W, 1%	81349	RN60C1002F
R14	Resistor, 5 k, 1/8 W, 1%	81349	RN60C5001F
R15	Resistor, variable, 5 k	80294	3009P-1-502
R16	Resistor, 100, 1/4 W, 5%	81349	RC07GF101J
R17	Resistor, 10 k, 1/8 W, 1%	81349	RN60C1002F
R18, R19	Resistor, 1 k, 1/8 W, 1%	81349	RN60C1001F
R20	Resistor, 1/8 W, 1%	81349	RN60C1002F
R21	Resistor, 1 k, 1/8 W, 1%	81349	RN60C1001F
S1	Switch, momentary		39-3
Z1	IC	01295	N5741V
Z1	IC	01295	SN7400N
Z3	IC	31439	ADC ECONOVERTR
Z4	IC	50507	MN13001
Z5-Z6	IC	01295	N5471V
Z7	IC	01295	SN74121N

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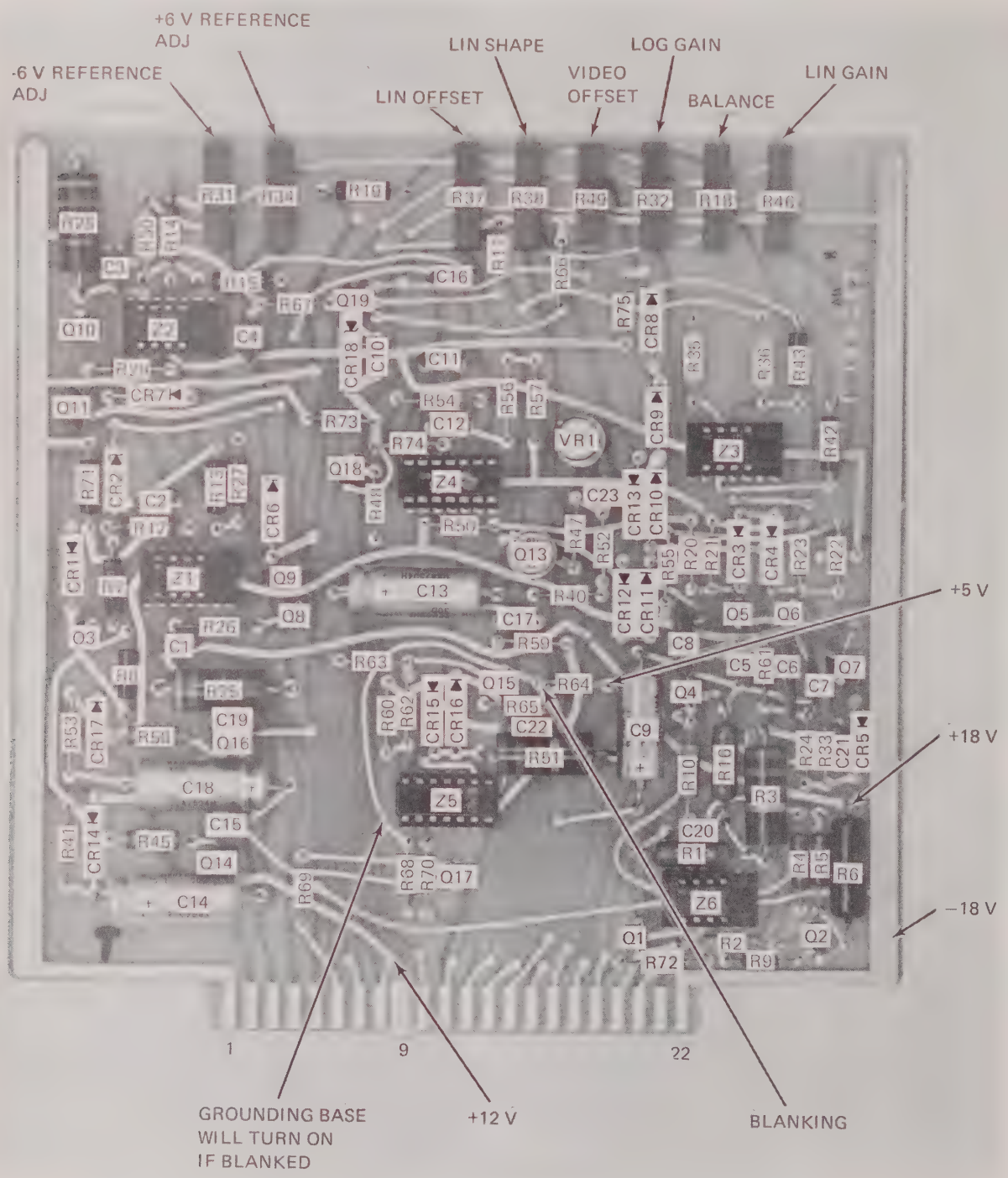
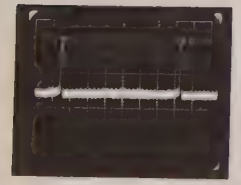


Figure 4-20. Preamplifier J4 Board (230480) (Sheet 1 of 2)

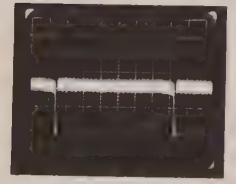
1 J4 Z5-1, 2
2V/cm
5 ms/cm
200 MHz/div
BASELINE CLIP ON

2 J4 PIN H - CONTRAST OUT
0.2 V/cm
5 ms/cm
OV BOTTOM OF SCREEN
BASELINE/CONTRAST ON

2 J4 PIN H - CONTRAST OUT
0.2 V/cm
5 ms/cm
BASELINE/CONTRAST OFF



3 J4 PIN U - VIDEO OUTPUT
0.1 V/cm
5 ms/cm
AC COUPLED
SIGNAL INPUT: 100 MHz COMB LINES
SCAN WIDTH = 100 MHz/div
0 dB ATTENUATION



4 J4 PIN V
0.5 V/cm
5 ms/cm
AC COUPLED
SIGNAL INPUT: 100 MHz COMB LINES
SCAN WIDTH = 200 MH/div
0 dB ATTENUATION

5 J4 PIN 6 - BLANKING OUTPUT
2 V/cm
5 ms/cm
BASELINE CLIPPING ON

5 J4 PIN 6 - BLANKING OUTPUT
2 V/cm
5 ms/cm
BASELINE CLIPPING OFF

NOTE: CENTER GRATICULE IS ZERO VOLTS
UNLESS OTHERWISE SPECIFIED.

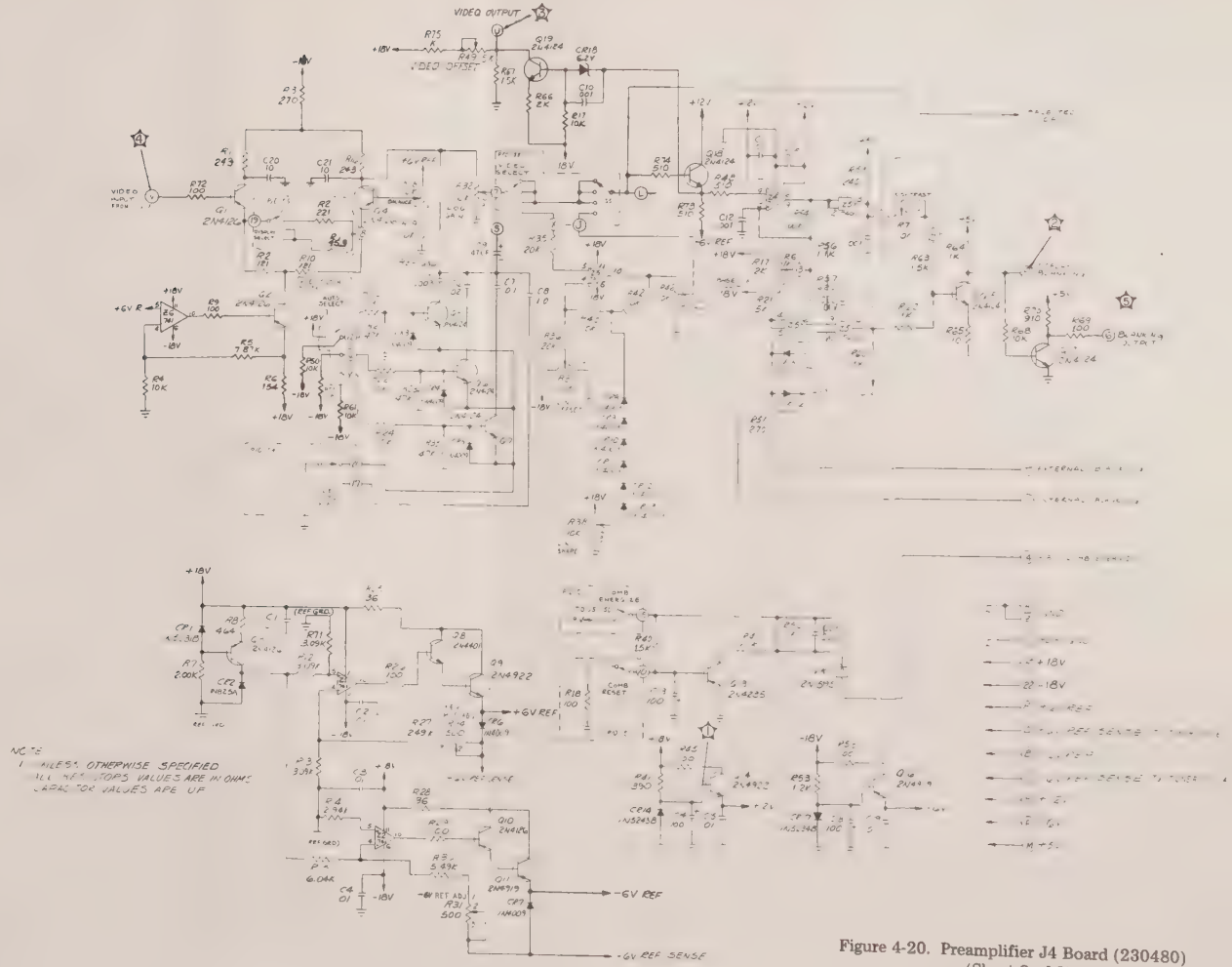


Figure 4-20. Preamplifier J4 Board (230480)
(Sheet 2 of 2)

PREAMPLIFIER J4 BOARD (230480)

Item	Description	FMC	Part No.
C1 thru C4	Capacitor. 0.01 μF	56289	5HKS-S10
C5	Capacitor, 0.003 μF	71590	DD-302
C6	Capacitor, 0.02 μF	71590	DD-203
C7	Capacitor, 0.1 μF, 75 V	71590	DDA-104
C8	Capacitor, 1.0 μF, 3 V	71590	UK-105
C9	Capacitor, 47 μF, 35 V	81349	CS13BF476K
C10	Capacitor, 0.001 μF	81349	CK60AW102M
C11	Capacitor, 0.01 μF	56289	5HKS-S10
C12	Capacitor, 0.001 μF	81349	CK60AW102M
C13, C14	Capacitor, 100 μF, 25 V	56289	TE-1211
C15, C16	Capacitor, 0.01 μF	56289	5HKS-S10
C17	Capacitor, 0.001 μF	81349	CK60AW102M
C18	Capacitor, 100 μF, 25 V	56289	TE-1211
C19	Capacitor, 0.01 μF	56289	5HKS-S10
C20, C21	Capacitor, 10 pF	71590	DD-100
C22, C23	Capacitor, 0.1 μF	56289	5HKS-S10
CR1	Diode	03508	1N5231B
CR2	Diode	05245	1N825A
CR3 thru CR13	Diode	03508	1N4009
CR14	Diode	03508	1N5243B
CR15, CR16	Diode	03508	1N2071 (114233-2)
CR17	Diode	03508	1N5234B
CR18	Diode	05245	1N825A
Q1 thru Q4	Transistor	49956	2N4126
Q5 thru Q7	Transistor	04713	2N4124
Q8	Transistor	04713	2N4401
Q9	Transistor	49956	2N4922
Q10	Transistor	49956	2N4126
Q11	Transistor	04713	2N4919
Q12	Not used		
Q13	Transistor	04713	2N4235
Q14	Transistor	49956	2N4922
Q15	Transistor	04713	2N4124
Q16	Transistor	04713	2N4919
Q17 thru Q19	Transistor	04713	2N4124
R1	Resistor, 243, 1/4 W	81349	RN65C2430F
R2	Resistor, 121, 1/8 W	81349	RN60C1210F
R3	Resistor, 270, 2 W	81349	RC42GF271J
R4	Resistor, 10 k, 1/8 W	81349	RN60C1002F
R5	Resistor, 7.87 k, 1/8 W	81349	RN60C7871F
R6	Resistor, 154, 1/2 W	81349	RN70D1540F
R7	Resistor, 2 k, 1/8 W	81349	RN60C2001F
R8	Resistor, 464, 1/8 W	81349	RN60C4640F
R9	Resistor, 100, 1/4 W	81349	RC07GF101J
R10	Resistor, 121, 1/8 W	81349	RN60C1210F
R11	Not used		

PREAMPLIFIER J4 BOARD (230480) (cont)

Item	Description	FMC	Part No.
R12, R13	Resistor, 3.09 k, 1/8 W	81349	RN60C3091F
R14	Resistor, 2.94 k, 1/8 W	81349	RN60C2941F
R15	Resistor, 6.04 k, 1/8 W	81349	RN60C6041F
R16	Resistor, 243, 1/4 W	81349	RN65C2430F
R17	Resistor, 10 k, 1/4 W	81349	RC07GF103J
R18	Resistor, variable, 10 k	80294	3009-P-103
R19	Resistor, 10 k, 1/8 W	81349	RN60C1002F
R20	Resistor, 10 k, 1/4 W	81349	RN07GF103J
R21	Resistor, 47 k, 1/4 W	81349	RC07GF473J
R22	Resistor, 10 k, 1/4 W	81349	RC07GF103J
R23	Resistor, 47 k, 1/4 W	81349	RC07GF473J
R24	Resistor, 10 k, 1/4 W	81349	RC07GF103J
R25	Resistor, 36, 2 W	81349	RC42GF360J
R26	Resistor, 100, 1/4 W	81349	RC07GF101J
R27	Resistor, 2.49 k, 1/8 W	81349	RN60C2491F
R28	Resistor, 36, 2 W	81349	RC42GF360J
R29	Resistor, 100, 1/4 W	81349	RC07GF101J
R30	Resistor, 5.49 k, 1/8 W	81349	RN60C5491F
R31	Resistor, variable, 500	80294	3009-P-501
R32	Resistor, variable, 10 k	80294	3009-P-103
R33	Resistor, 47 k, 1/4 W	81349	RC07GF473J
R34	Resistor, variable, 500	80294	3009-P-501
R35, R36	Resistor, 20 k, 1/8 W	81349	RN60C2002F
R37, R38	Resistor, variable, 10 k	80294	3009-P-103
R39	Not used		
R40	Resistor, 15 k, 1/4 W	81349	RC07GF153J
R41	Resistor, 390, 1/4 W	81349	RC07GF391J
R42, R43	Resistor, 10 k, 1/8 W	81349	RN60C1002F
R44	Not used		
R45	Resistor, 100, 1/2 W	81349	RC20GF101J
R46	Resistor, variable, 10 k	80294	3009-P-103
R47	Resistor, 1.1 k, 1/4 W	81349	RC07GF112J
R48	Resistor, 510, 1/4 W	81349	RC07GF511J
R49	Resistor, variable, 5 k	80294	3009P-1-502
R50	Resistor, 10 k, 1/4 W	81349	RC07GF103J
R51	Resistor, 270, 2 W	81349	RC42GF271J
R52	Resistor, 1 k, 1/4 W	81349	RC07GF102J
R53	Resistor, 1.2 k, 1/4 W	81349	RC07GF122J
R54	Resistor, 100 k, 1/4 W	81349	RC07GF104J
R55	Resistor, 10 k, 1/4 W	81349	RC07GF103J
R56	Resistor, 1.1 k, 1/4 W	81349	RC07GF112J
R57	Resistor, 620, 1/4 W	81349	RC07GF621J
R58	Resistor, 100, 1/2 W	81349	RC20GF101J
R59	Resistor, 240, 1/4 W	81349	RC07GF241J
R60	Resistor, 1 k, 1/4 W	81349	RC07GF102J
R61	Resistor, 10 k, 1/4 W	81349	RC07GF103J

PREAMPLIFIER J4 BOARD (230480) (cont)

Item	Description	FMC	Part No.
R62	Resistor, 1 k, 1/4 W	81349	RC07GF102J
R63	Resistor, 1.5 k, 1/4 W	81349	RC07GF152J
R64	Resistor, 1 k, 1/4 W	81349	RC07GF102J
R65	Resistor, 10, 1/4 W	81349	RC07GF100J
R66	Resistor, 2 k, 1/4 W	81349	RC07GF202J
R67	Resistor, 1.5 k, 1/4 W	81349	RC07GF152J
R68	Resistor, 10 k, 1/4 W	81349	RC07GF103J
R69	Resistor, 100, 1/4 W	81349	RC07GF101J
R70	Resistor, 910, 1/4 W	81349	RC07GF911J
R71	Resistor, 3.09 k, 1/8 W	81349	RN60C3091F
R72	Resistor, 100, 1/4 W	81349	RC07GF101J
R73, R74	Resistor, 510, 1/4 W	81349	RC07GF511J
R75	Resistor, 1 k, 1/4 W	81349	RC07GF102J
VR1	Transistor	01295	2N1595
Z1 thru Z3	IC	01295	SN72741P
Z4	IC	01295	SN72710N
Z5	IC	01295	SN7400N
Z6	IC	01295	SN72741P

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Figure 4-21. Power Supply (230426-2) (Sheet 1 of 2)

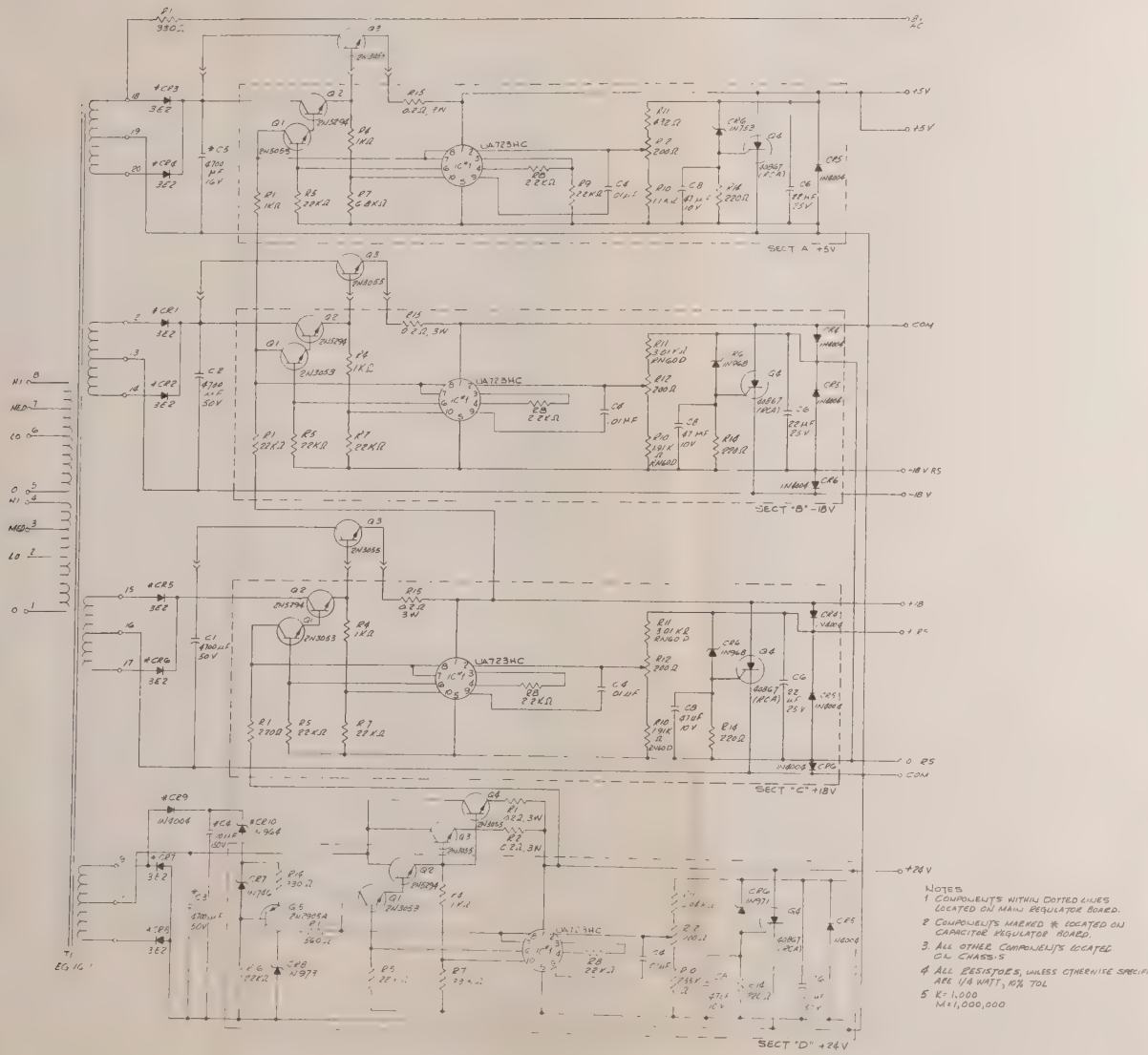


Figure 4-21. Power Supply (230426-2) (Sheet 2 of 2)

POWER SUPPLY (230426-2)

Item	Description	FMC	Part No.
C1	Capacitor, 68 μF, 63 V	25403	ET680X063A00
C2	Capacitor, 0.01 μF, 250 V	25403	C280AE/A10K
C3	Capacitor, 68 μF, 63 V	25403	ET680X063A00
C4	Capacitor, 0.01 μF, 250 V	25403	C280AE/A10K
C5	Capacitor, 68 μF, 63 V	25403	ET680X063A00
C6	Capacitor, 0.01 μF, 250 V	25403	C280AE/A10K
C7	Capacitor, 68 μF, 63 V	25403	ET680X063A00
C8	Capacitor, 0.01 μF, 250 V	25403	C280AE/A10K
C9	Capacitor, 150 μF, 25 V	25403	ET151X025A6
C10, C11	Capacitor, 3.3 μF, 25 V	25403	ETEP3X025A1
C101	Capacitor, 8000 μF, 40 V	03508	86F5613M1
C102	Capacitor, 4000 μF, 40 V	03508	86F156M1
C103 thru C106	Capacitor, 0.220 μF, 250 V, 10%	25403	C280AE/A220K
C107	Capacitor, 5200 μF, 30 V	03508	86F147M1
CR1, CR2	Diode	03508	1N5059
CR3 thru CR5	Diode	03508	1N645
CR6 thru CR9	Diode	03508	1N5059
CR101, CR102	Diode	03508	1N1202A
CR103 thru CR106	Diode	03508	A15A
Q1 thru Q6	Transistor	49956	2N3567
Q7	Transistor	49956	2N5135
Q8 thru Q20	Transistor	49956	2N3567
Q101 thru Q108	Transistor	01295	2N3055
R1	Resistor, 270, 1/2 W, 10%	01121	RC20GF271K
R2	Resistor, 1.2 k, 1/2 W, 10%	01121	RC20GF122K
R3	Resistor, 470, 1/2 W, 10%	01121	RC20GF471K
R4	Resistor, 8.2 k, 1/2 W, 10%	01121	RC20GF822K
R5	Resistor, 10 k, Pot WW	71450	BK64204
R6	Resistor, 470, 1/2 W, 10%	01121	RC20GF471K
R7	Resistor, 82 k, 1/2 W, 10%	01121	RC20GF823K
R8	Resistor, 470, 1/2 W, 10%	01121	RC20GF471K
R9	Resistor, 22 k, 1/2 W, 10%	01121	RC20GF222K
R10	Resistor, 470, 1/2 W, 10%	01121	RC20GF471K
R11	Resistor, 2.49 k, 3 W, WW, 1%	09969	RW79U2491F
R12	Resistor, 8.2 k, 1/2 W, 10%	01121	RC20GF822K
R13	Resistor, 4.7 k, 1/2 W, 10%	01121	RC20GF472K
R14	Resistor, 1 k, 3 W, WW, 1%	09969	RW79U1001F
R15	Resistor, 2.49, 3 W, WW, 1%	09969	RW79U2491F
R16	Resistor, variable, 500, WW	71450	BK64200
R17	Resistor, 3.3 k, 1/2 W, 10%	01121	RC20GF332F
R18, R19	Resistor, 0.33 5 W	75042	PW5
R20	Resistor, 470, 1/2 W, 10%	01121	RC20GF471K
R21, R22	Resistor, 8.2 k, 1/2 W, 10%	01121	RC20GF822K
R23	Resistor, 470, 1/2 W, 10%	01121	RC20GF471K
R24	Resistor, variable, 10 k, WW	71450	BK64204

POWER SUPPLY (230426-2) (cont)

Item	Description	FMC	Part No.
R25	Resistor, 68 k, 1/2 W, 10%	01121	RC20GF683K
R26	Resistor, 3.3 k, 1/2 W, 10%	01121	RC20GF332K
R27	Resistor, 470, 1/2 W, 10%	01121	RC20GF471K
R28	Resistor, 2.2 k, 1/2 W, 10%	01121	RC20GF222K
R29	Resistor, 2.05 k, 3 W, WW, 1%	09969	RW79U2051F
R30	Resistor, 470, 1/2 W, 10%	01121	RC20GF471K
R31	Resistor, 3.3 k, 1/2 W, 10%	01121	RC20GF332K
R32	Resistor, 1 k, 3 W, WW 1%	09969	RS941001F
R33	Resistor, 2.05 k, 3 W, WW, 1%	09969	RW79U2051F
R34	Resistor, variable, 500, WW	71450	BK64200
R35	Resistor, 0.33, 5 W	75042	PW5
R36	Resistor, 680, 1/2 W, 10%	01121	RC20GF681F
R37	Resistor, 8.2 k, 1/2 W, 10%	01121	RC20GF822K
R38	Resistor, 470, 1/2 W, 10%	01121	RC20GF471K
R39	Resistor, variable, 10 k, WW	71450	BK64204
R40	Resistor, 68 k, 1/2 W, 10%	01121	RC20GF683K
R41	Resistor, 470, 1/2 W, 10%	01121	RC20GF471K
R42	Resistor, 2.2 k, 1/2 W, 10%	01121	RC20GF222K
R43	Resistor, 120 k, 1/2 W, 10%	01121	RC20GF124K
R44	Resistor, 1 k, 1/2 W, 10%	01121	RC20GF102K
R45	Resistor, 10 k, 1/2 W, 10%	01121	RC20GF103K
R46	Resistor, 820, 1/2 W, 10%	01121	RC20GF821K
R47	Resistor, 1.2 k, 1/2 W, 10%	01121	RC20GF122K
R48	Resistor, 8.2 k, 1/2 W, 10%	01121	RC20GF822K
R49	Resistor, 4.7 k, 1/2 W, 10%	01121	RC20GF472K
R50	Resistor, variable, 500, WW	71450	BK64200
R51	Resistor, 1.87 k, 3 W, WW, 1%	09969	RW79U1871F
R52	Resistor, 2.05 k, 3 W, WW, 1%	09969	RW79U2051F
R53	Resistor, 0.1, 5 W	75042	PW5
R54	Resistor, 470, 1/2 W, 10%	01121	RC20GF471K
R55	Resistor, 8.2 k, 1/2 W, 10%	01121	RC20GF822K
R56	Resistor, 3.3 k, 1/2 W, 10%	01121	RC20GF332K
R57	Resistor, 1.87 k, 3 W, WW, 1%	09969	RW79U1871F
R58	Resistor, 8.2 k, 1/2 W, 10%	01121	RC20GF822K
R59	Resistor, 1.5 k, 1/2 W, 10%	01121	RC20GF152K
R60	Resistor, 470, 1/2 W, 10%	01121	RC20GF471K
R61	Resistor, variable, 10 k, WW	71450	BK64204
R62	Resistor, 15 k, 1/2 W, 10%	01121	RC20GF153K
R63	Resistor, 470, 1/2 W, 10%	01121	RC20GF471K
R64	REsistor, 820, 1/2 W, 10%	01121	RC20GF821K
R65, R66	Resistor, 2.2 k, 1/2 W, 10%	01121	RC20GF222K
R67	Resistor, 1 k, 1/2 W, 10%	01121	RC20GF102K
R68	Resistor, variable, 250, WW	71450	BK64199
R69	Resistor, 442, 3 W, WW, 1%	09969	RW79U4420F
R70	Resistor, 1 k, 3 W, WW, 1%	09969	RW791001F
R71, R72	Resistor, 100, 1/2 W, 10%	01121	RC20GF101K

POWER SUPPLY (230426-2) (cont)

Item	Description	FMC	Part No.
SCR1, SCR2	Silcon Cont Rect	04713	C122F
TB1	Terminal Block	75382	600-8
TH1	Thermostat 85° NC	74389	Model U
T1	Transformer	09004	C18260
VR1	Diode, zener	81031	1N765B
VR2	Diode, zener	81031	1N821
VR3	Diode, zener	81031	1N756A
VR4	Diode, zener	81031	1N963B
VR5	Diode, zener	81031	1N821
VR6	Diode, zener	81031	1N963B
VR7	Diode, zener	81031	1N748
VR8	Diode, zener	81031	1N821
VR9	Diode, zener	81031	1N753A
VR10	Diode, zener	81031	1N970B
VR11	Diode, zener	81031	1N971B
VR12	Diode, zener	81031	1N970B
C1 thru C3	Capacitor, electrolytic, 4700 μF, 50 V	03508	86F556
C4	Capacitor, electrolytic, 10 μF, 150 V	56289	TE1507
CR1 thru CR5	Diode	81031	3E2
CR5A thru CR5D	Diode	81031	1N4224
CR6	Diode	81031	3E2
CR6A	Diode	81031	1N753
CR6B, CR6C	Diode	81031	1N968
CR6D	Diode	81031	1N971
CR7	Diode	81031	3E2
CR7D	Diode	81031	1N746
CR8	Diode	81031	3E2
CR9	Diode	81031	1N4004
CR10	Diode	81031	1N964
1C1A thru 1C1D	IC	07263	UA723HC
Q1A thru Q1D	Transistor	81031	2N3053
Q2A thru Q2D	Transistor	81031	2N5294
Q3A thru Q3D	Transistor	81031	2N3055
Q4A thru Q4D	SCR		40867
Q5D	Transistor	81031	2N2905A
R1	Resistor, 330, 1/4 W	81031	RC07GF331J
R1A	Resistor, 1000, 1/4 W	81031	RC07GF102J
R1B	Resistor, 2200, 1/4 W	81031	RC07GF222J
R1C	Resistor, 220, 1/4 W	81031	RC07GF221J
R1D	Resistor, 560, 1/4 W	81031	RC07GF561J
R4A thru R4D	Resistor, 1000, 1/4 W	81031	RC07GF102J
R5A thru R5D	Resistor, 22 k, 1/4 W	81031	RC07GF223J
R6	Not Used		

POWER SUPPLY (230426-2) (cont)

Item	Description	FMC	Part No.
R7A	Resistor, 6800, 1/4 W	81031	RC07GF682J
R7B, R7C	Resistor, 4700, 1/4 W	81031	RC07GF472J
R7D	Resistor, 22 k, 1/4 W	81031	RC07GF223J
R8A thru R8D	Resistor, 2200, 1/4 W	81031	RC07GF222J
R9A	Resistor, 2200, 1/4 W	81031	RC07GF222J
R10A	Resistor, 1100, 1/4 W	81031	RN60D1101F
R10B, R10C	Resistor, 1910, 1/4 W	81031	RN60D1911F
R10D	Resistor, 2550, 1/4 W	81031	RN60D2551F
R11A	Resistor, 432, 1/4 W	81031	RN50D4320F
R11B, R11C	Resistor, 3010, 1/4 W	81031	RN60D3010F
R11D	Resistor, 6040, 1/4 W	81031	RN60D6040F
R12A thru R12D	Resistor, variable, 200		MTC2261
R13	Not used		
R14A thru R14D	Resistor, 220, 1/4 W	81031	RC07GF221J
R16D	Resistor, 22 k, 1/4 W	81031	RC07GF223J
R17D	Resistor, 330, 1/4 W	81031	RC07GF331J
T1	Transformer, power		EG16-1

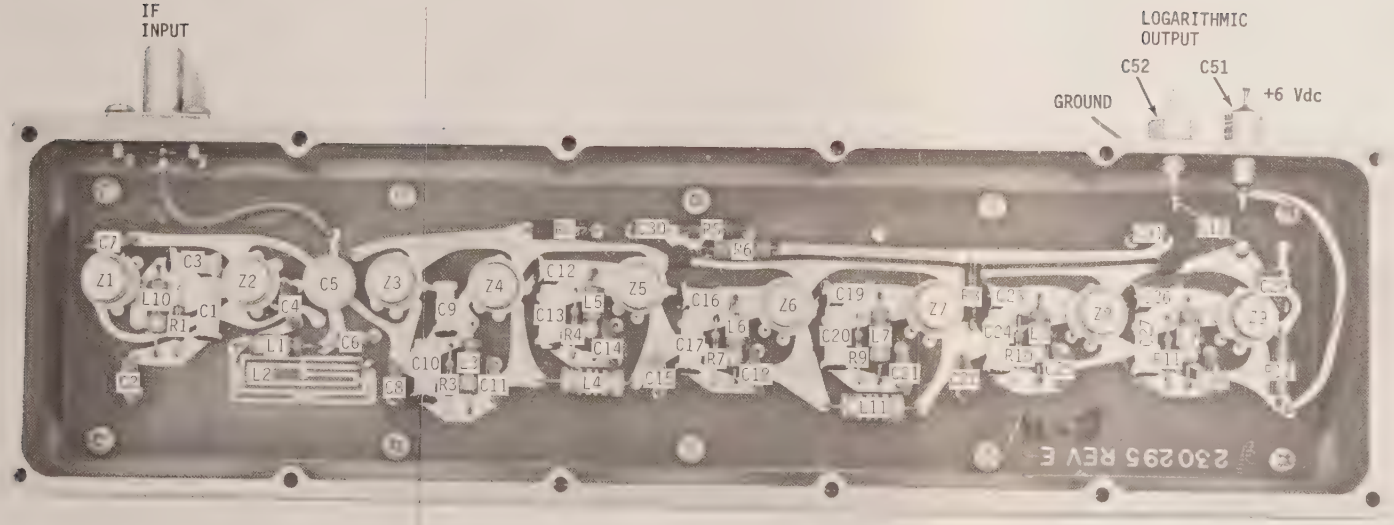


Figure 4-22. Log IF Amplifier (299462) (Sheet 1 of 2)

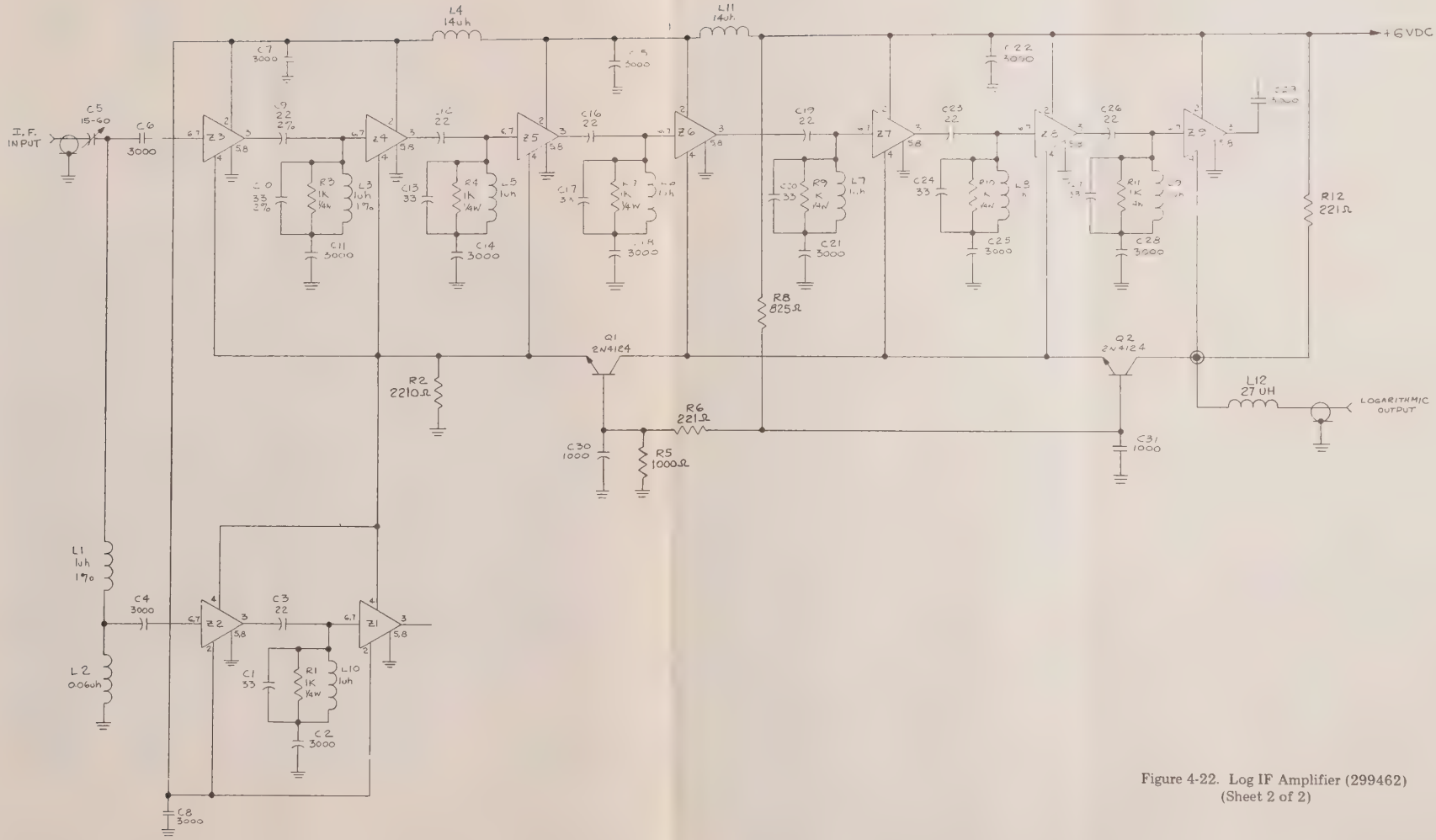


Figure 4-22. Log IF Amplifier (299462)
(Sheet 2 of 2)

LOG IF AMPLIFIER (299462)

Item	Description	FMC	Part No.
C51	Capacitor, filter	50056	MF204
C52	Capacitor, feed-thru, 1000 pF	00752	208674-1
L12	Inductor, fixed, 27 μH	71895	1025-54
	LOG IF Board	00752	230294

LOG IF BOARD (230924)

Item	Description	FMC	Part No.
C1	Capacitor, 33 pF, ±2%	72982	308-00-COGO330G
C2	Capacitor, 3000 pF	71590	DD-302
C3	Capacitor, 22 pF, ±2%	72982	301-00-COGO220G
C4	Capacitor, 3000 pF	71590	DD-302
C5	Capacitor, variable, 15-60 pF	72982	538-011-F15-60
C6 thru C8	Capacitor, 3000 pF	71590	DD-302
C9	Capacitor, 22 pF, ±2%	72982	301-000-COGO220G
C10	Capacitor, 33 pF, ±2%	72982	308-000-COGO330G
C11	Capacitor, 3000 pF	71590	DD-302
C12	Capacitor, 22 pF, ±2%	72982	301-000-COGO220G
C13	Capacitor, 33 pF, ±2%	72982	308-000-COGO330G
C14, C15	Capacitor, 3000 pF	71590	DD-302
C16	Capacitor, 22 pF, ±2%	72982	301-000-COGO220G
C17	Capacitor, 33 pF, ±2%	72982	308-000-COGO330G
C18	Capacitor, 3000 pF	71590	DD-302
C19	Capacitor, 22 pF, ±2%	72982	301-000-COGO220G
C20	Capacitor, 33 pF, ±2%	72982	308-000-COGO330G
C21, C22	Capacitor, 3000 pF	71590	DD-302
C23	Capacitor, 22 pF, ±2%	72982	301-000-COGO220G
C24	Capacitor, 33 pF, ±2%	72982	308-000-COGO330G
C25	Capacitor, 3000 pF	71590	DD-302
C26	Capacitor, 22 pF, ±2%	72982	301-000-COGO220G
C27	Capacitor, 33 pF, ±2%	72982	308-000-COGO330G
C28, C29	Capacitor, 3000 pF	71590	DD-302
C30, C31	Capacitor, 1000 pF	81349	CK60AW102M
C32 thru C50	Not used		
L1	Inductor, 1 μH, 1%	97469	4425-6F
L2	Not used		
L3	Inductor, 1 μH, 1%	97469	4425-6F
L4	Inductor, 14 μH	00752	115297-2
L5 thru L10	Inductor, 1 μH, 1%	97469	4425-6F
L11	Inductor, 14 μH	00752	115297-2
Q1, Q2	Transistor	04713	2N4124
R1	Resistor, 1 k, 1/4 W	81349	RC07GF102J
R2	Resistor, 2.21 k, 1/8 W	81349	RN60C2211F
R3, R4	Resistor, 1 k, 1/4 W	81349	RC07GF102J
R5	Resistor, 1 k, 1/8 W	81349	RN60C1001F
R6	Resistor, 221, 1/8 W	81349	RN60C2210F
R7	Resistor, 1 k, 1/4 W	81349	RC07GF102J
R8	Resistor, 825, 1/8 W	81349	RN60C8250F
R9 thru R11	Resistor, 1 k, 1/4 W	81349	RC07GF102J
R12	Resistor, 221, 1/8 W	81349	RN60C2210F
Z1 thru Z9	IC	00752	230541-3

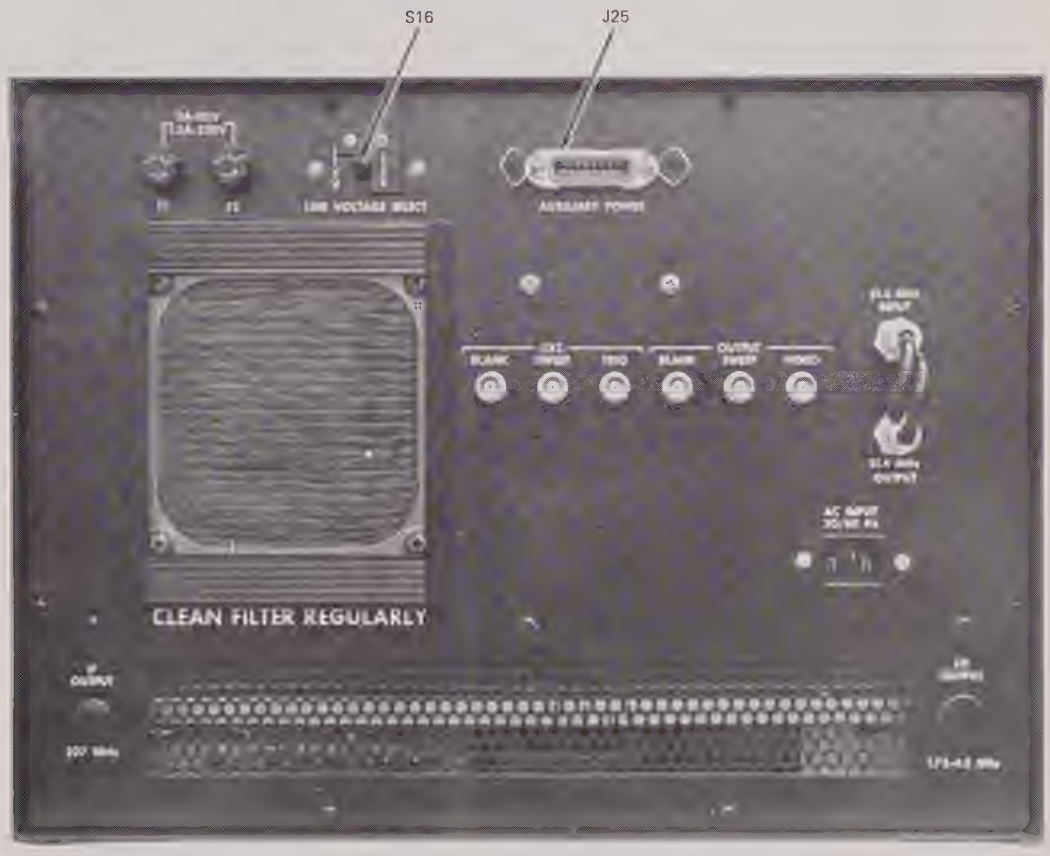


Figure 4-23. Rear Panel

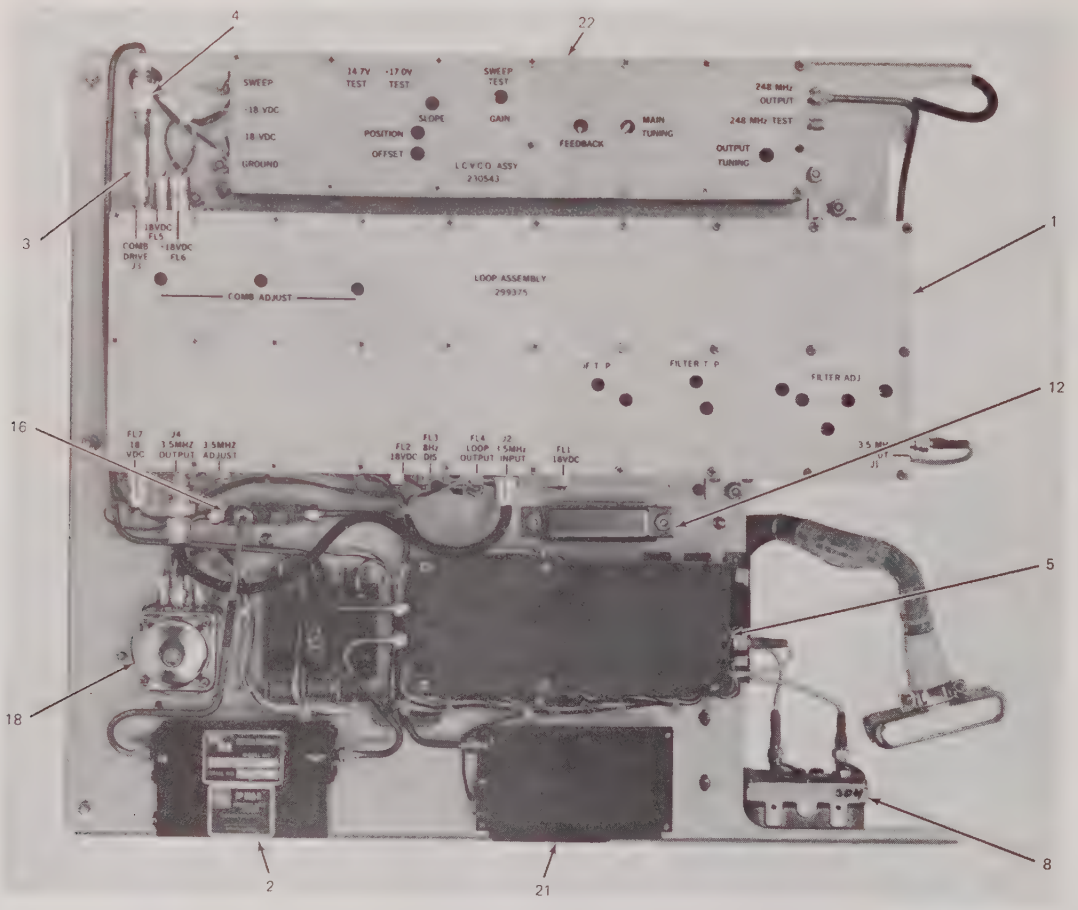


Figure 4-24. RF ASSEMBLY (299352) (Sheet 1 of 2)

RF ASSEMBLY (299352)

Item	Description	FMC	Part No.
1	Loop Assembly	00752	299375
2	Isolator	00752	230215
3	Comb Generator	00752	230471-2
4	Fixed Attenuator (10 db)	00752	230195-3
5	Loop Mixer/Filter	00752	230224
6	Mixer Bias Assembly	00752	230500
7	Band Pass Filter	00752	299374
8	RF Amplifier Assembly (15 db)	00752	230625
9	IF Assembly	00752	299350
10	RF Switch	00752	231079
11	Low Pass Filter	00752	230191
12	Microwave Mixer	00752	230567
13	Amplifier Assembly (20 db)	00752	230719

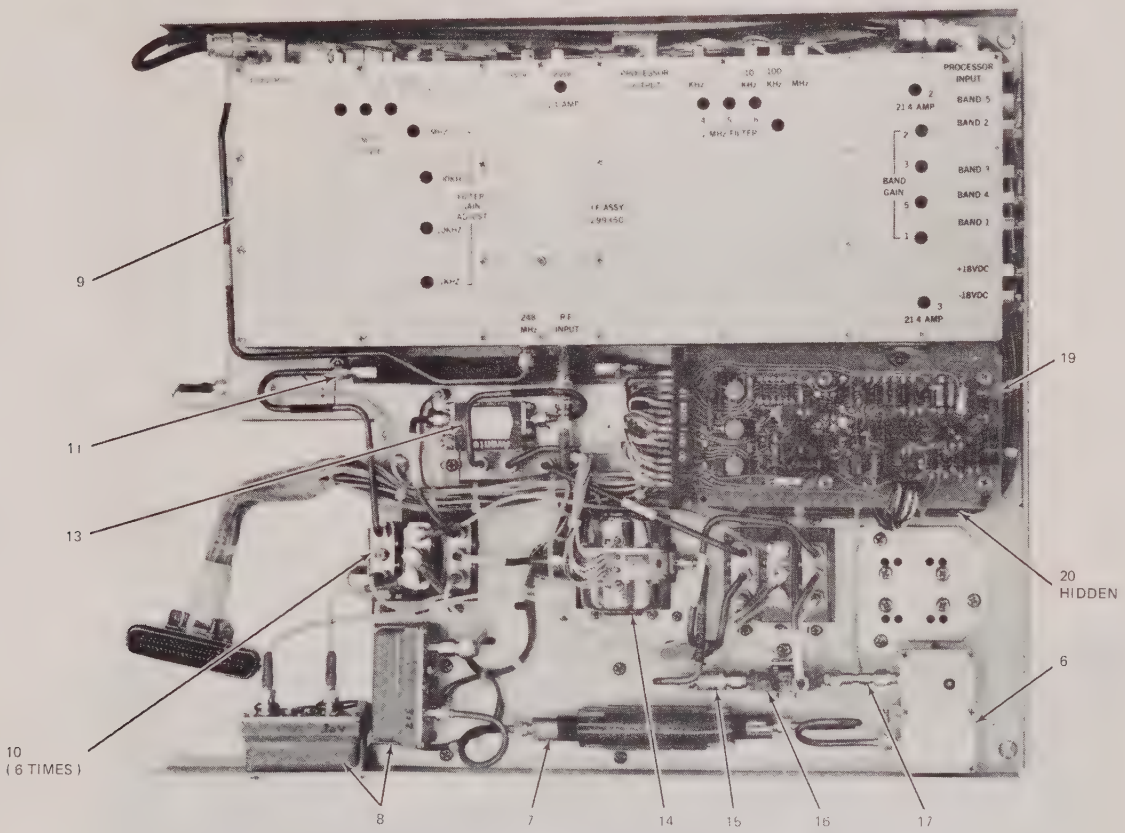


Figure 4-24. RF ASSEMBLY (299352) (Sheet 2 of 2)

RF ASSEMBLY (299352)

Item	Description	FMC	Part No.
14	YIG Filter	00752	29963
15	Fixed Attenuator (6 db)	00752	230195-5
16	Coupler, 6 db	00752	230194
17	Harmonic Mixer	00752	230478
18	YIG Oscillator (VCO)	00752	230186
19	YIG Driver Board	00752	299395
20	YIG Driver Heat Sink Assembly	00752	299400
21	2060 Oscillator	00752	230817
22	LCVCO Assembly	00752	230543
CR1, CR2	Diode		1N2071
R1	Resistor		RC42GF390J

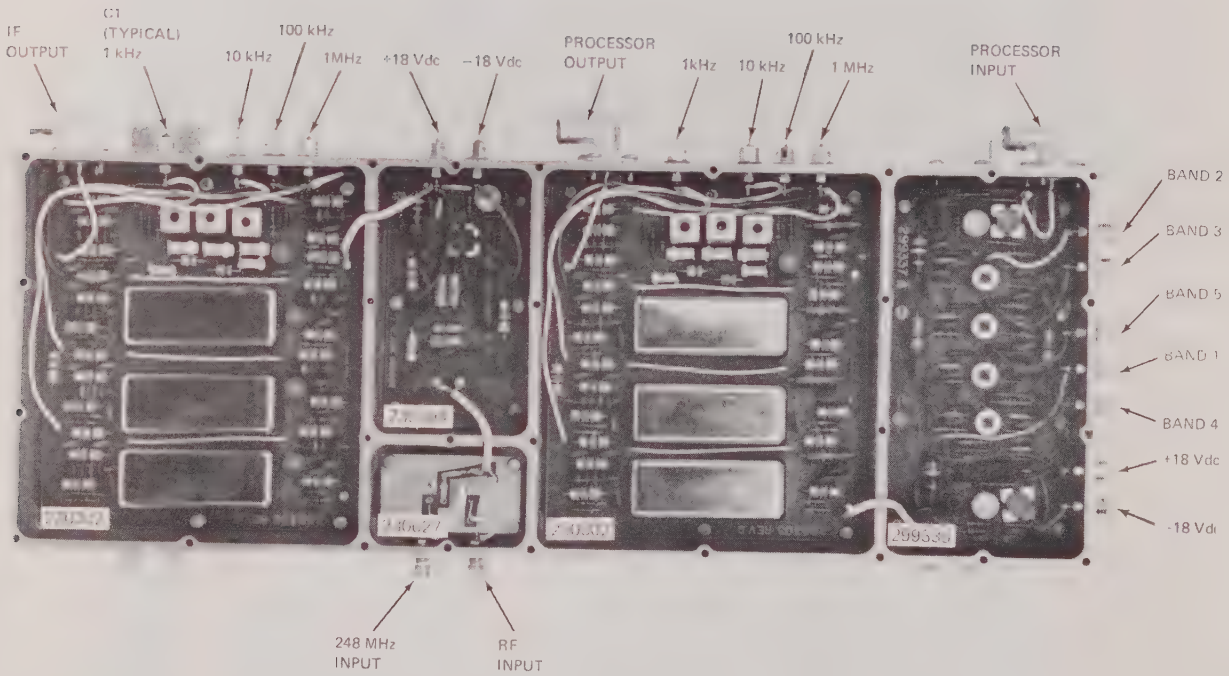


Figure 4-25. IF Assembly (299350)

IF ASSEMBLY (299350)

Item	Description	FMC	Part No.
C1 thru C17	Capacitor, filter	50056	MF204
R17	Resistor, 10 k, 1/4 W	81349	RC07GF103J
	Filter Board	00752	230302-1
	Filter Board	00752	230302-2
	Processor Board	00752	299335
	IF Amplifier Board	00752	230394
	Mixer Board	00752	230627

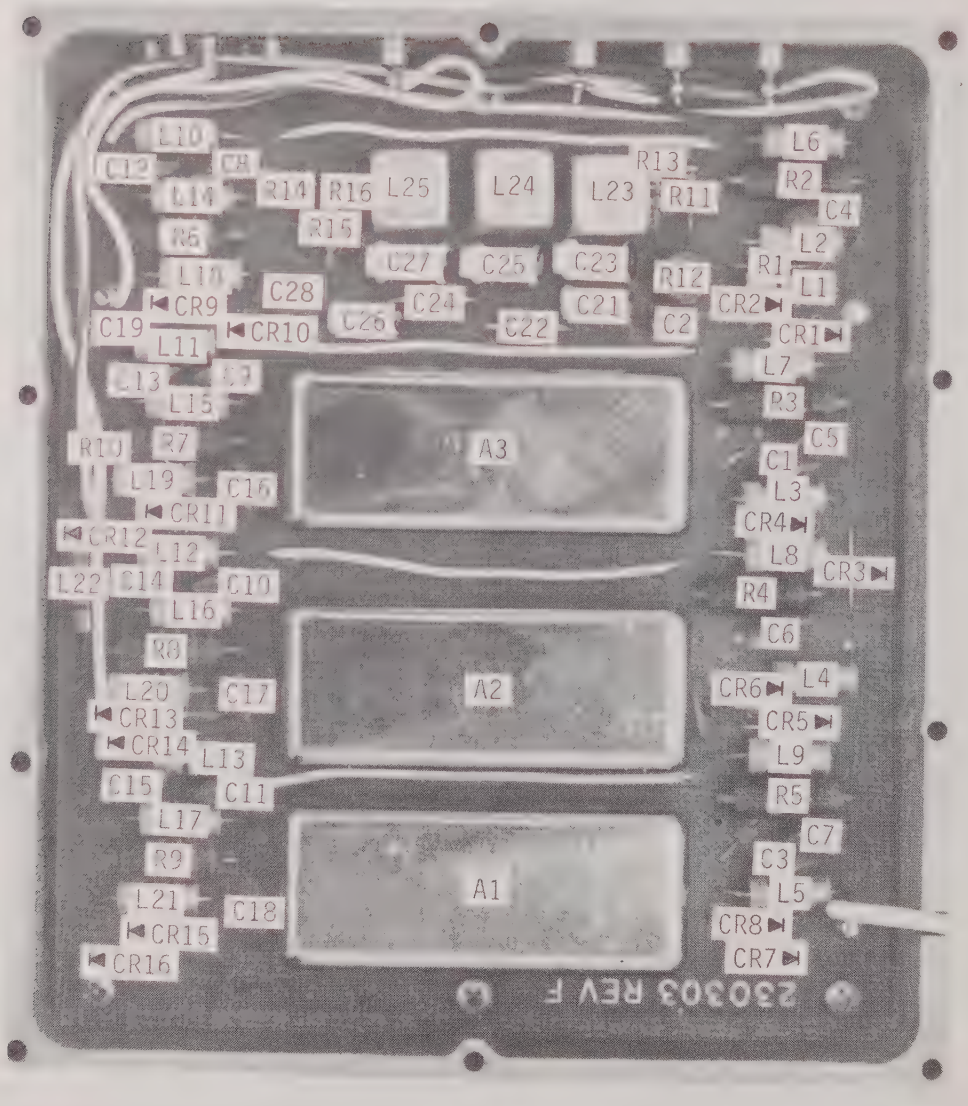
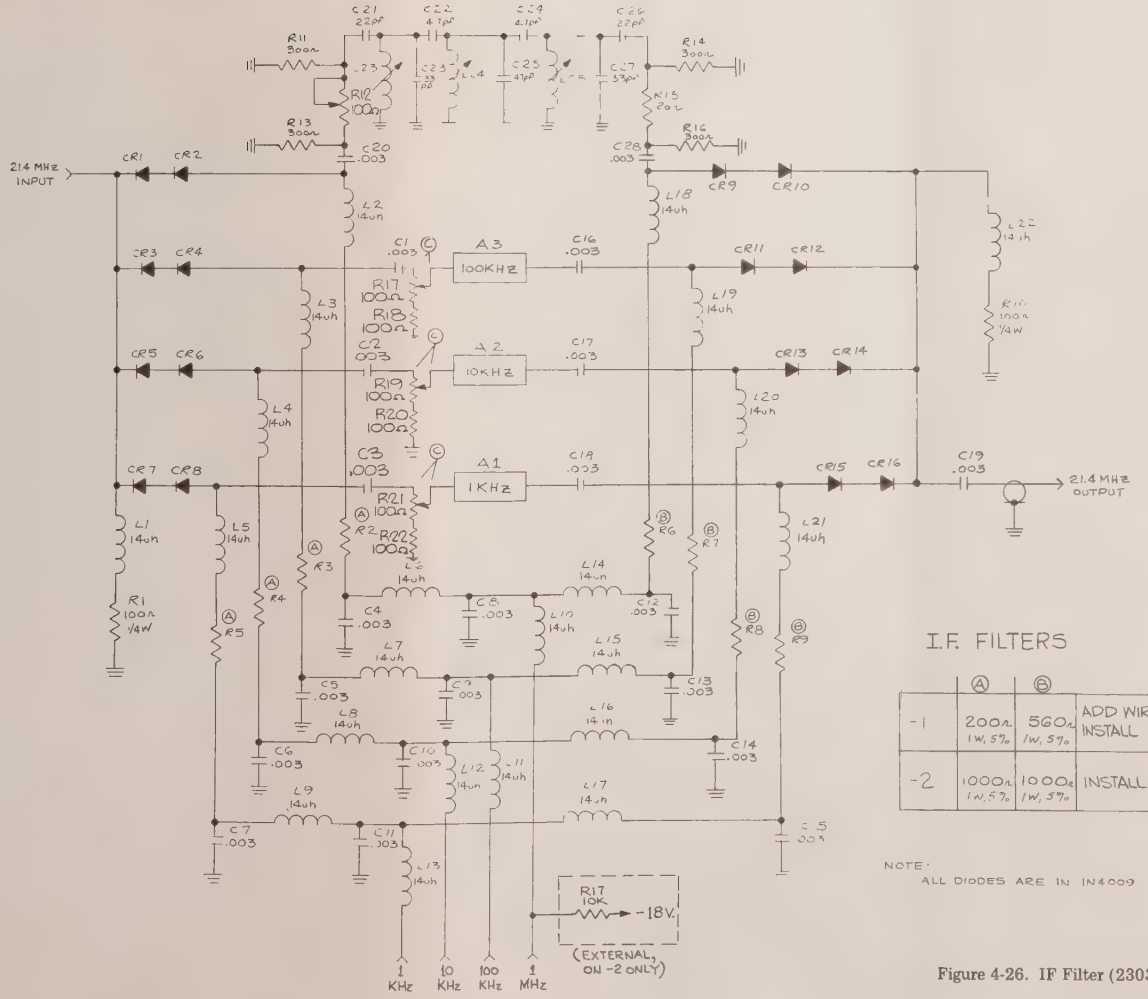


Figure 4-26. IF Filter (230302) (Sheet 1 of 2)



I.F. FILTERS

	Ⓐ	Ⓑ	Ⓒ
-1	200Ω 1W, 5%	560Ω 1W, 5%	ADD WIRE JUMPER - DONOT INSTALL R17 THRU R22
-2	1000Ω 1W, 5%	1000Ω 1W, 5%	INSTALL R17 THRU R22

NOTE:
ALL DIODES ARE IN 4009

Figure 4-26. IF Filter (230302) (Sheet 2 of 2)

IF FILTER BOARD (230302)

Item	Description	FMC	Part No.
A1	Crystal filter	00752	231012-1
A2	Crystal filter	00752	231012-2
A3	Crystal filter	00752	231012-3
C1 thru C20	Capacitor, 3000 pF	71590	DD-302
C21	Capacitor, 22 pF	72982	301-000-COGO-220G
C22	Capacitor, 4.7 pF	78488	Stackpole GA
C23	Capacitor, 33 pF	72982	308-000-COGO-330G
C24	Capacitor, 4.7 pF	78488	Stackpole GA
C25	Capacitor, 47 pF	72982	308-000-COGO-470G
C26	Capacitor, 22 pF	72982	301-000-COGO-220G
C27	Capacitor, 33 pF	72982	308-000-COGO-330G
C28	Capacitor, 3000 pF	72982	DD-302
CR1 thru CR16	Diode	03508	1N4009
L1 thru L22	Inductor, 14 μH	00752	115297-2
L23 thru L25	Inductor, variable	04213	435-3
R1	Resistor, 100, 1/4 W	81349	RC07GF101J
R2 thru R5	Resistor, 200, 1 W, 5%	81349	RC32GF201J
R6 thru R9	Resistor, 560, 1 W, 5%	81349	RC32GF561J
R10	Resistor, 100, 1/4 W	81349	RC07GF101J
R11	Resistor, 300, 1/4 W	81349	RC07GF301J
R12	Resistor, variable, 100	80294	3339P-1-101
R13, R14	Resistor, 300, 1/4 W	81349	RC07GF301J
R15	Resistor, 20, 1/4 W	81349	RC07GF200J
R16	Resistor, 300, 1/4 W	81349	RC07GF301J
R17 (-2)	Resistor, variable, 100	80294	3339P-1-101
R18 (-2)	Resistor, 100, 1/4 W	81349	RC07GF101J
R19 (-2)	Resistor, variable, 100	80294	3339P-1-101
R20 (-2)	Resistor, 100, 1/4 W	81349	RC07GF101J
R21 (-2)	Resistor, variable, 100	80294	3339P-1-101
R22 (-2)	Resistor, 100, 1/4 W		RC07GF101J

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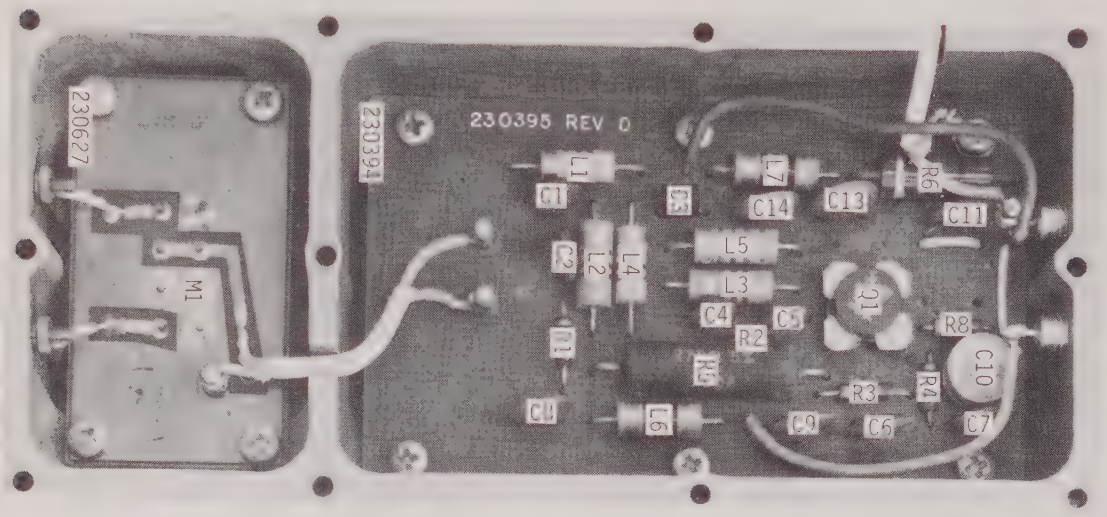


Figure 4-27. IF Amplifier (230394) (Sheet 1 of 2)

IF AMPLIFIER BOARD (230394)

Item	Description	FMC	Part No.
C1, C2	Capacitor, 100 pF	71590	DD-101
C3	Capacitor, 220 pF	71590	CK05CW221K
C4, C5	Capacitor, 100 pF	71590	DD-101
C6 thru C9	Capacitor, 0.003 μF	71590	DD-302
C10	Capacitor, variable 15-60 pF	81349	538-011-F-15-60
C11	Capacitor, 0.003 μF	71590	DD-302
C12	Not used		
C13, C14	Capacitor, 0.003 μF	71590	DD-302
L1	Inductor, 0.15 μH	71895	1537-00
L2, L3	Inductor, 0.25 μH	97469	115297-1
L4	Inductor, 0.15 μH	71895	1537-00
L5	Inductor, 3 μH	97469	115297-4
L6, L7	Inductor, 14 μH	97469	115297-2
Q1	Transistor	00752	230541-1
R1, R2	Resistor, 51, 1/4 W	81349	RC07GF510J
R3, R4	Resistor, 20, 1/4 W	81349	RC07GF200J
R5	Resistor, 270, 5 W, 5%	09969	RS-5, 270, 5%
R6	Resistor, 39, 1 W	81349	RC32GF101J
R7	Not used		
R8	Resistor, 47, 1/4 W	81349	RC07GF470J

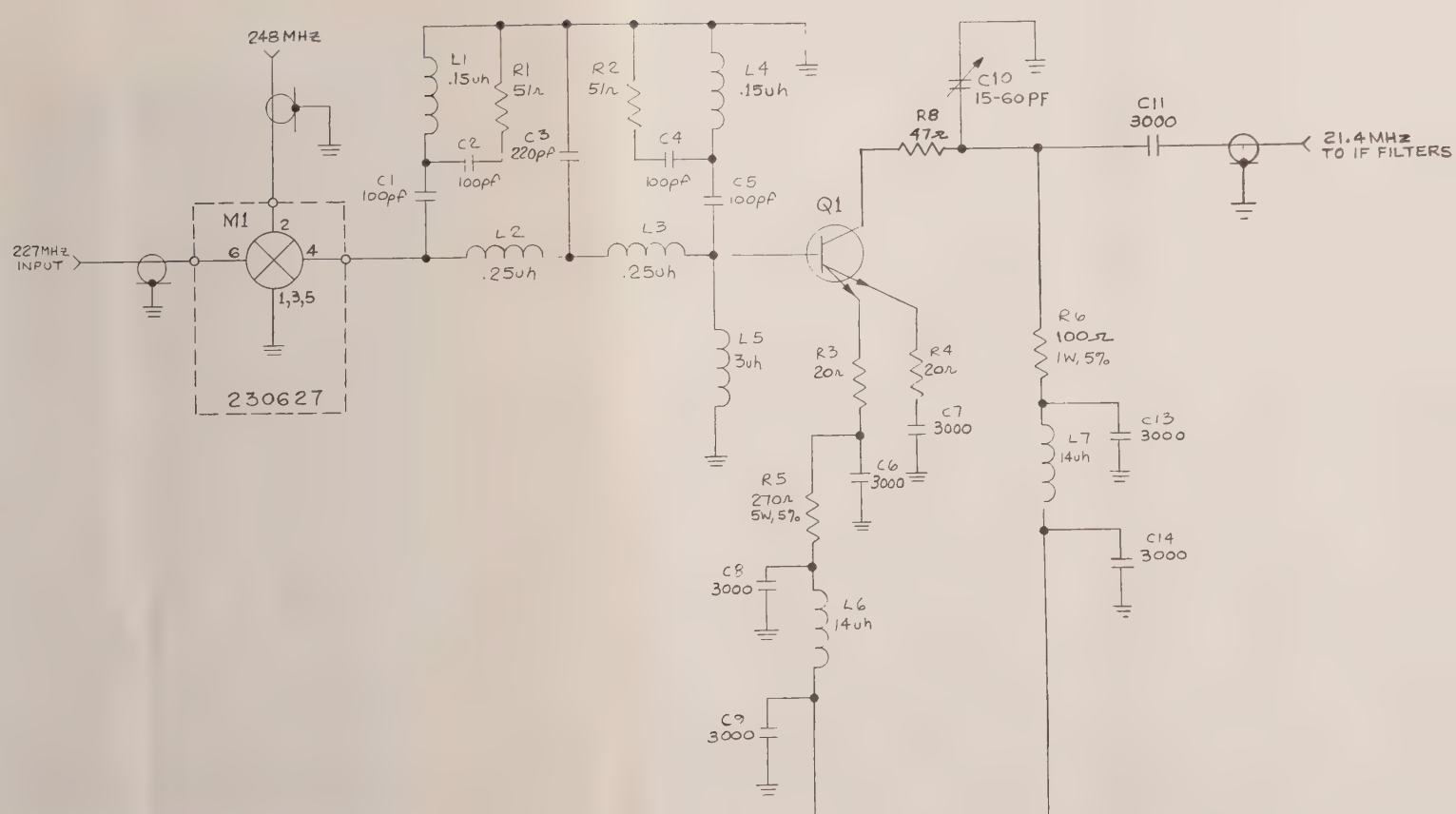


Figure 4-27. IF Amplifier (230394) (Sheet 2

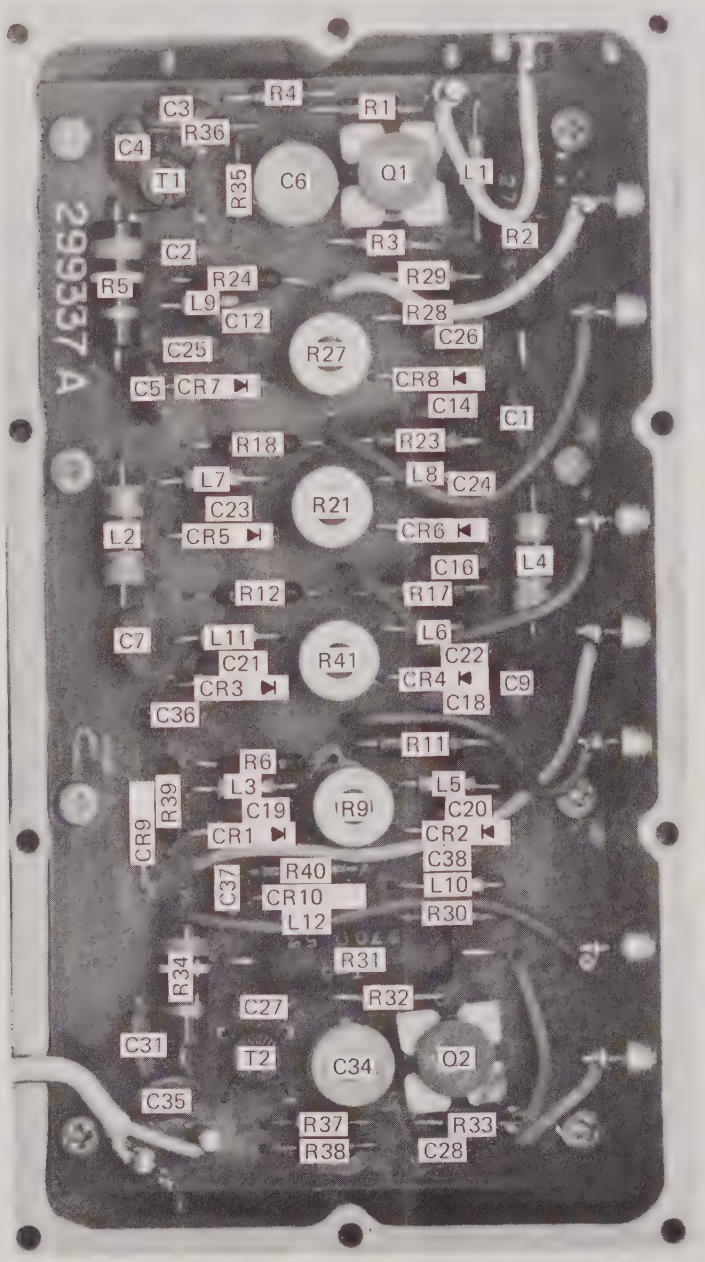


Figure 4-28. IF Processor (299338) (Sheet 1 of 2)

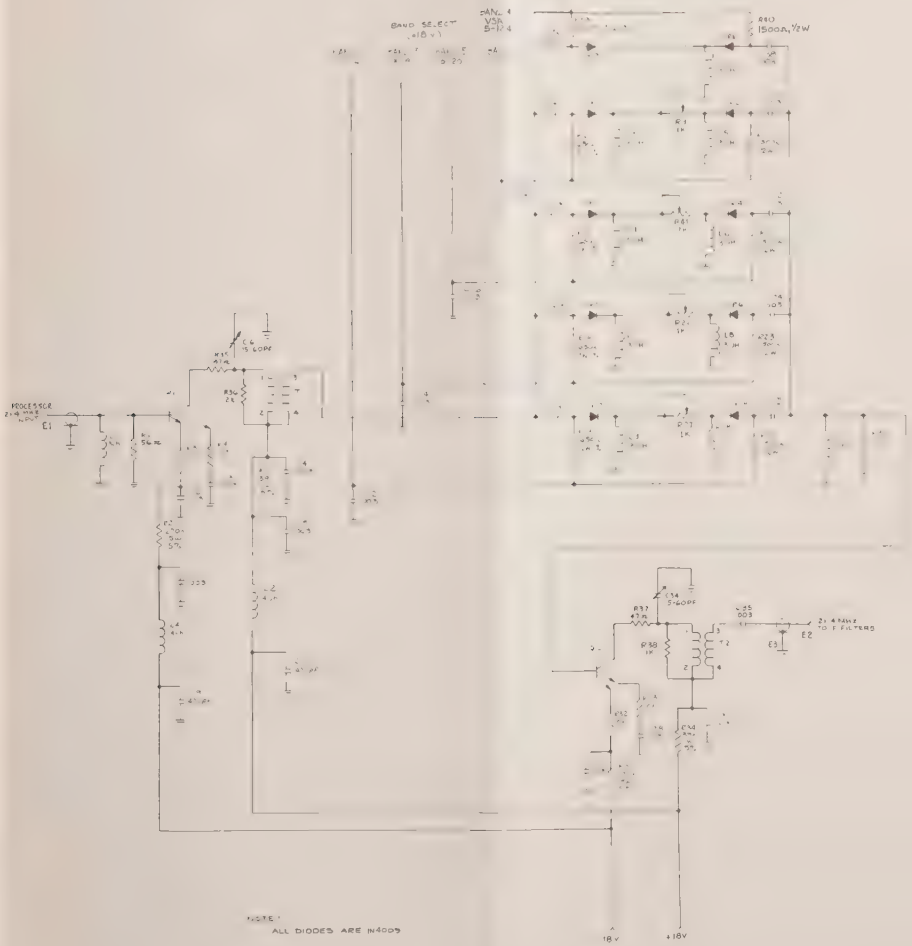


Figure 4-28. IF Processor (299338) (Sheet 2 of 2)

IF PROCESSOR BOARD (299338)

Item	Description	FMC	Part No.
C1 thru C5	Capacitor, 3000 pF	71590	DD-302
C6	Capacitor, variable, 15-60 pF	72982	538-011-F15-60
C7	Capacitor, 470 pF	81349	CK60AX471K
C8	Not used		
C9	Capacitor, 470 pF	81349	CK60AX471K
C10, C11	Not used		
C12	Capacitor, 3000 pF	71590	DD-302
C13	Not used		
C14	Capacitor, 3000 pF	71590	DD-302
C15	Not used		
C16	Capacitor, 3000 pF	71590	DD-302
C17	Not used		
C18 thru C28	Capacitor, 3000 pF	71590	DD-302
C29, C30	Not used		
C31	Capacitor, 3000 pF	71590	DD-302
C32, C33	Not used		
C34	Capacitor, variable, 15-60 pF	72982	538-011-F15-60
C35 thru C38	Capacitor, 3000 pF	71590	DD-302
CR1 thru CR10	Diode	03508	1N4009
L1	Inductor, 3.3 μH	71895	1025-32
L2	Inductor, 14 μH	00752	115297-2
L3	Inductor, 3.3 μH	71895	1025-32
L4	Inductor, 14 μH	00752	115297-2
L5 thru L12	Inductor, 3.3 μH	71895	1025-32
Q1, Q2	Transistor	00752	230541-1
R1	Resistor, 56, 1/4 W	81349	RC07GF560J
R2	Resistor, 270, 5 W, 5%	09969	RS-5
R3, R4	Resistor, 10, 1/4 W	81349	RC07GF100J
R5	Resistor, 39, 1 W, 5%	81349	RC32GF390J
R6	Resistor, 650, 1%, 1 W	09969	RS-1A
R7, R8	Not used		
R9	Resistor, variable, 1 k	01121	SV1021
R10	Not used		
R11	Resistor, 1.5 k, 1/2 W	81349	RC20GF152J
R12	Resistor, 650, 1%, 1 W	09969	RS-1A
R13 thru R16	Not used		
R17	Resistor, 1.5 k, 1/2 W	81349	RC20GF152J
R18	Resistor, 650, 1%, 1 W	09969	RS-1A
R19, R20	Not used		
R21	Resistor, variable, 1 k	01121	SV1021
R22	Not used		
R23	Resistor, 1.5 k, 1/2 W	81349	RC20GF152J
R24	Resistor, 650, 1%, 1 W	09969	RS-1A
R25	Not used		
R26	Not used		

IF PROCESSOR BOARD (299338) (cont)

Item	Description	FMC	Part No.
R27	Resistor, variable, 1 k	01121	SV1021
R28	Resistor, 62, 1/4 W	81349	RC07GF620J
R29	Resistor, 1.5 k, 1/2 W	81349	RC20GF152J
R30	Resistor, 200, 1/4 W	81349	RC07GF201J
R31	Resistor, 270, 5 W, 5%	09969	RS-5
R32, R33	Resistor, 10, 1/4 W	81349	RC07GF100J
R34	Resistor, 39, 1 W, 5%	81349	RC32GF390J
R35	Resistor, 47, 1/4 W	81349	RC07GF470J
R36	Resistor, 2 k, 1/4 W	81349	RC07GF202J
R37	Resistor, 47, 1/4 W	81349	RC07GF470J
R38	Resistor, 1 k, 1/4 W	81349	RC07GF102J
R39	Resistor, 650, 1%, 1 W	09969	RS-1A
R40	Resistor, 1.5 k, 1/2 W	81349	RC20GF152J
R41	Resistor, variable, 1 k	01121	SV1021
T1, T2	Transformer	00752	230531-3

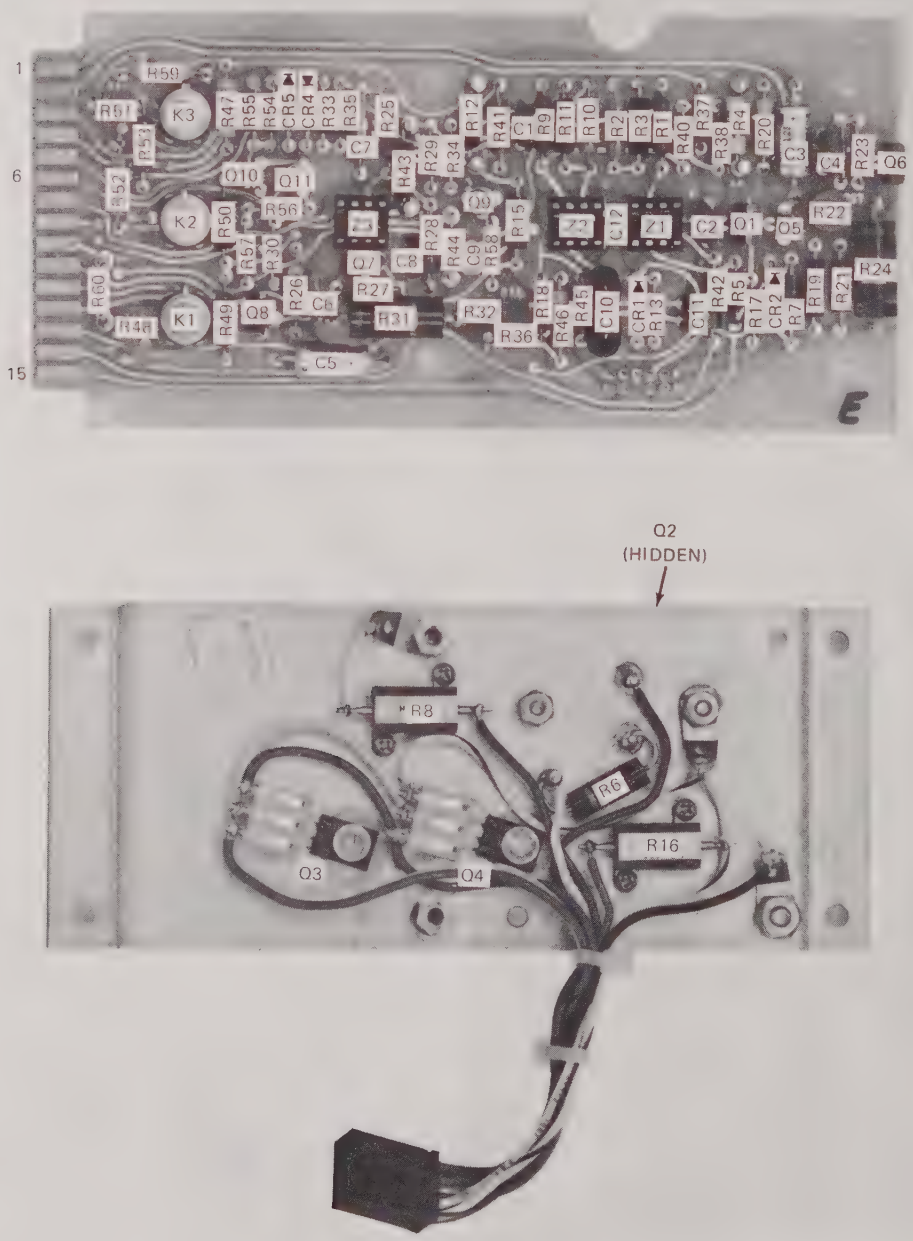
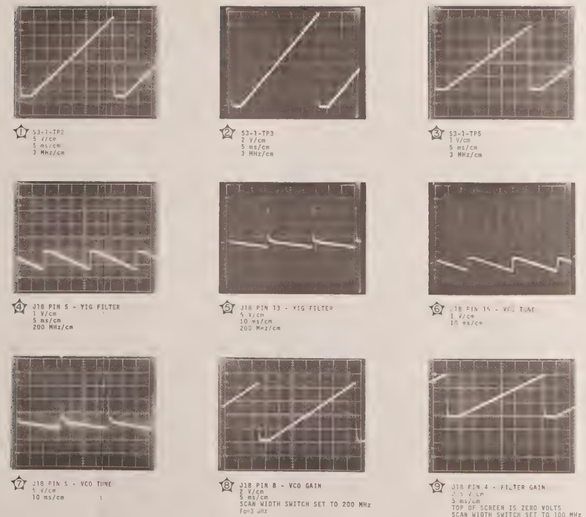


Figure 4-29. YIG Driver J18 Board (299400) (Sheet 1 of 2)



NOTE: CENTER GRATICULE IS ZERO VOLTS UNLESS OTHERWISE INDICATED.

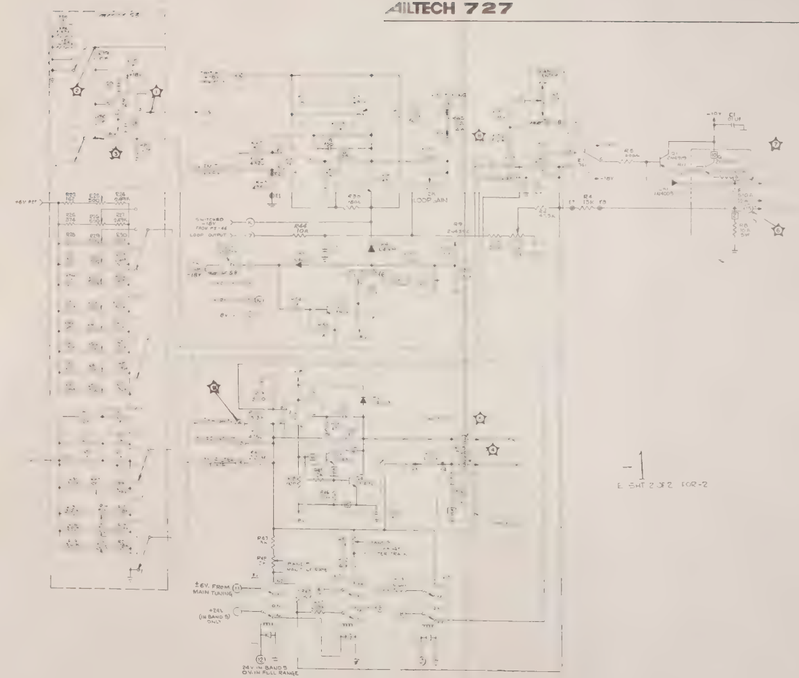


Figure 4-29. YIG Driver J18 Board (299400)
(Sheet 2 of 2)

YIG DRIVERS ASSEMBLY (299400)

Item	Description	FMC	Part No.
Q2	Transistor	04713	2N4902
Q4	Transistor	04713	2N4902
R6	Resistor, 10, 1 W	81349	RC32GF100J
R8	Resistor, 10, 5 W, 1%	09969	RE60G10R1
R16	Resistor, 10, 5 W, 1%	09969	RE60G10R0
	YIG Drivers Board	00752	230547

YIG DRIVER J18 BOARD (299400)

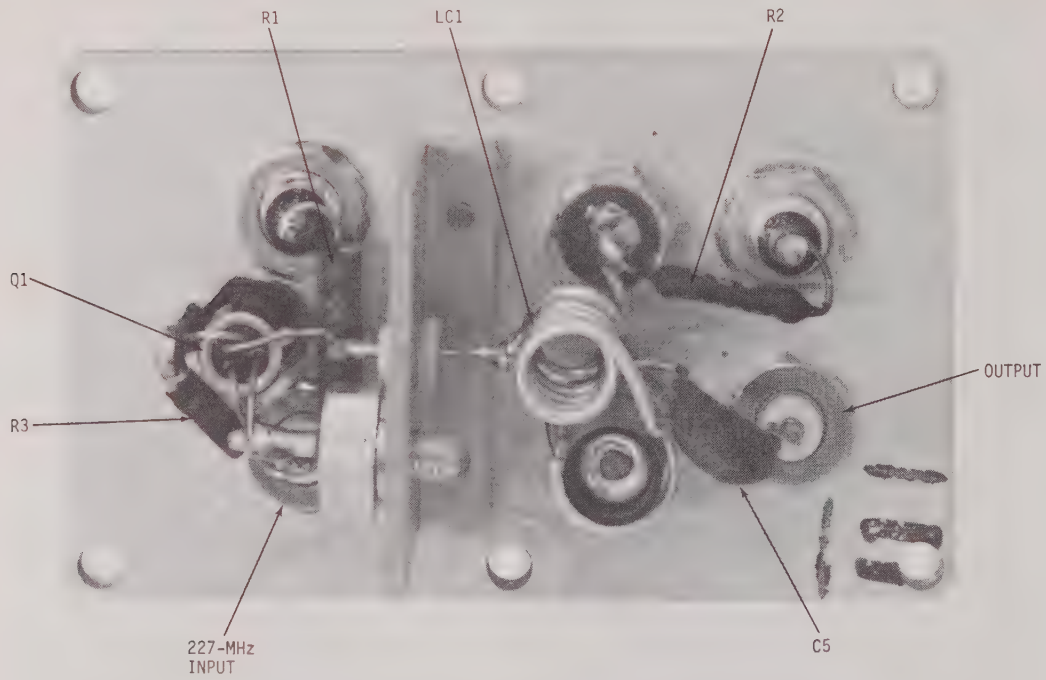
Item	Description	FMC	Part No.
C1, C2	Capacitor, 0.01 μF	56289	5HKS-S10
C3	Capacitor, 10 μF, 12 V	56289	TE-1128
C4	Not used		
C5	Capacitor, 2 μF, 50 V	56289	TE-1301
C6	Capacitor, 0.005 μF	71590	DD-502
C7	Capacitor, 1.2 μF, 20 V	56289	CS13BE125K
C8	Capacitor, 100 pF	72136	DM5-101-J
C9	Capacitor, 0.1 μF	72982	8121-050-651-1C4M
C10	Capacitor, 4300 pF		CM06FD432J03
C11	Capacitor, 6.8 μF, 35 V	05397	T368B685M035AS
C12	Capacitor, 12 pF	00752	299241-120
CR1, CR2	Diode	03508	1N4009
CR3	Not used		
CR4, CR5	Diode	03508	1N4009
**K1 thru K3	Relay, double pole, double throw		712DM-26 Teledyne
Q1-Q7	Transistor	04713	2N4919
Q8	Transistor		2N4922
Q9	Transistor	04713	2N4392
Q10	Transistor	49956	2N4126
Q11	Transistor	04713	2N4392
R1	Resistor, 5.11 k, 1/8 W	81349	RN60C5111F
R2	Resistor, 90.9 k, 1/8 W	81349	RN60C9092F
R3	Resistor, 39.2 k, 1/8 W	81349	RN60C3922F
R4	Resistor, 13.0 k, 1/8 W	81349	RN60C1302F
R5	Resistor, 1 k, 1/4 W	81349	RC07GF102J
R6	Not used		
R7	Resistor, 510, 1/2 W	81349	RC20GF511J
R8	Not used		
R9	Resistor, 5.11 k, 1/8 W	81349	RN60C511F
R10	Resistor, 13.3 k, 1/8 W	81349	RN60C1332F
R11	Resistor, 4.75 k, 1/8 W	81349	RN60C4751F
R12	Resistor, 4.02 k, 1/8 W	81349	RN60C4021F

**Parts used only on 299395-1 board.

YIG DRIVER J18 BOARD (299400) (cont)

Item	Description	FMC	Part No.
R13	Resistor, 47, 1/4 W	81349	RC07GF470J
R14	Not Used		
R15	Resistor, 560, 1/2 W	81349	RC20GF561J
R16	Not used		
R17	Resistor, 200, 1/4 W	81349	RC07GF201J
R18	Resistor, 100, 1/4 W	81349	RC07GF101J
R19 thru R24	Not used		
R25	Resistor, 5.11,k, 1/8 W	81349	RN60C5111F
R26	Resistor, 4.32 k, 1/8 W	81349	RN60C4321F
R27	Resistor, 180, 1/4 W	81349	RC07GF181J
R28	Resistor, 10 k, 1/8 W	81349	RN60C1002F
R29	Resistor, 47, 1/4 W	81349	RC07GF470J
R30	Resistor, 180, 1/4 W	81349	RC07GF181J
R31	Resistor, 150, 2 W	81349	RC42GF151J
R32	Resistor, variable, 2 k	80294	3279W-1-202
R33	Resistor, 100 k, 1/4 W	81349	RC07GF104J
R34	Resistor, 100 k, 1/4 W	81349	RC07GF104J
R35	Resistor, 510 k, 1/4 W	81349	RC07GF514J
R36	Resistor, variable, 1 k	80294	3279W-1-102
R37	Resistor, 1 meg, 1/4 W	81349	RC07GF105J
R38	Resistor, 5.6 k, 1/4 W	81349	RC07GF562J
R39	Not used		
R40	Resistor, 20 k, 1/4 W	81349	RC07GF203J
R41	Resistor, 47.5 k, 1/8 W	81349	RN60C4752F
R42	Resistor, 2.21 meg, 1/8 W	81349	RN60C2214F
R43	Resistor, 4.75* k, 1/8 W	81349	RN60C4751F
R44	Resistor, 10, 1/4 W	81349	RC07GF100J
R45	Resistor, 1.2 k, 1/4 W	81349	RC07GF122J
R46	Resistor, 301, 1/8 W	81349	RN60C3010F
**R47	Resistor, 13 k, 1/8 W	81349	RN60C1302F
**R48	Resistor, variable, 2 k	80294	3279W-1-202
**R49	Resistor, 182 k, 1/8 W	81349	RN60C1823F
**R50	Resistor, 619 k, 1/8 W	81349	RN60C6193F
**R51	Resistor, variable, 10 k	80294	3279W-1-103
**R52	Resistor, 40 k, 1/8 W	81349	RN60C4002F
**R53	Resistor, 4.64 k, 1/8 W	81349	RN60C4641F
R54	Resistor, 10 k, 1/4 W	81349	RC07GF103J
R55	Resistor, 1 k, 1/4 W	81349	RC07GF102J
R56	Resistor, 100 k, 1/4 W	81349	RC07GF104J
R57	Resistor, 10 k, 1/4 W	81349	RC07GF103J
R58	Resistor, 20 k, 1/4 W	81349	RC07GF203J
**R59	Resistor, 61.9 k, 1/8 W	81349	RN60C6192F
R60	Resistor, 10, 1/4 W	81349	RC07GF100J
Z1 thru Z3	Integrated Circuit	01295	SN72741P

*Resistor value selected at test during manufacture.
**Parts used only on 399395-1 board.



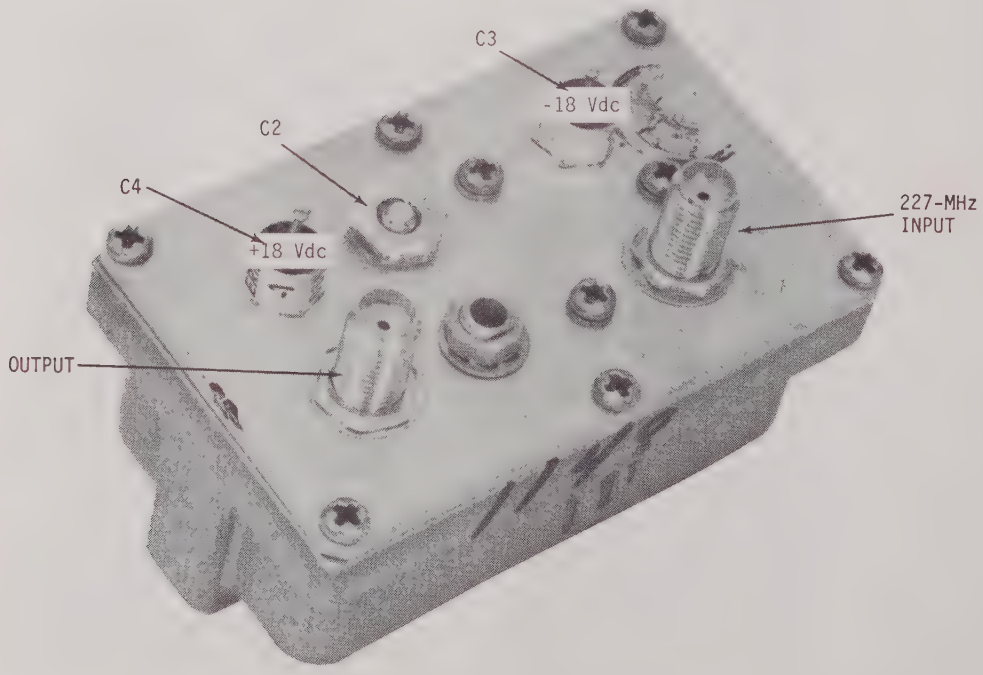


Figure 4-30. RF Amplifier (230625) (Sheet 1 of 2)

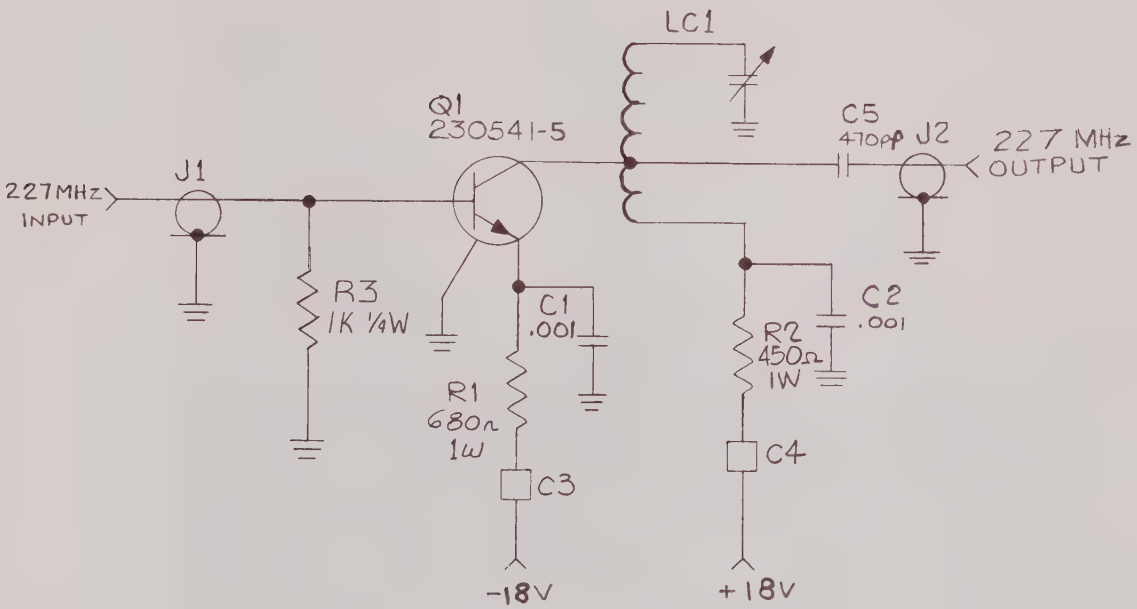


Figure 4-30. RF Amplifier (230625) (Sheet 2 of 2)

RF AMPLIFIER ASSEMBLY (230625)

Item	Description	FMC	Part No.
C1, C2	Capacitor, standoff, 1000 pF	00752	208674-2
C3, C4	Capacitor, filter	50056	MF204
C5	Capacitor, disc, 470 pF	81349	CK60AX471K
L1	Not used		
LC1	Tank circuit	73899	LC-374
Q1	Transistor	00752	230541-5
R1	Resistor, 680, 1 W, ±5%	09969	RS-1A
R2	Resistor, 450, 1 W, ±5%	09969	RS-1A
R3	Resistor, 1 k, 1/4 W	81349	RC07GF102J

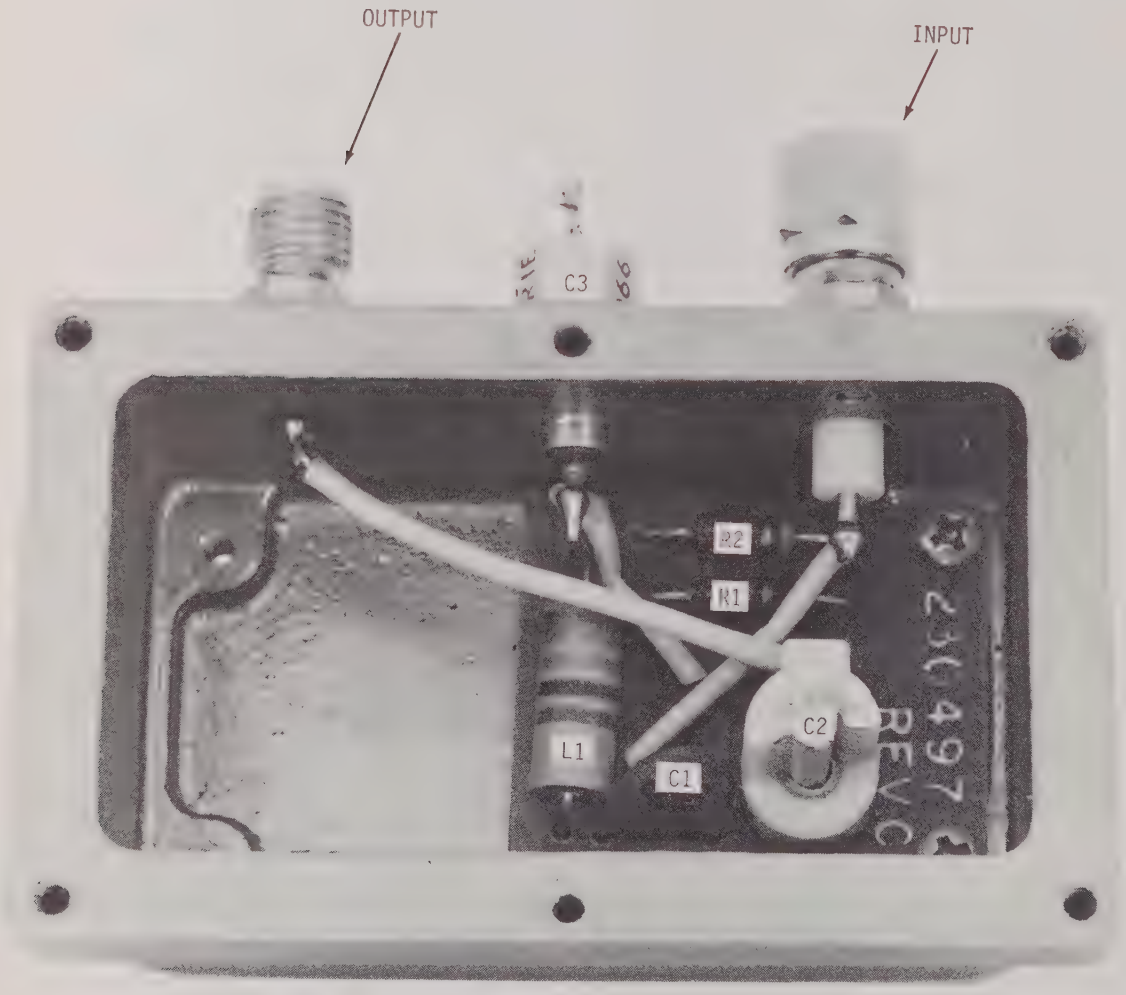


Figure 4-31. Mixer Bias (230500) (Sheet 1 of 2)

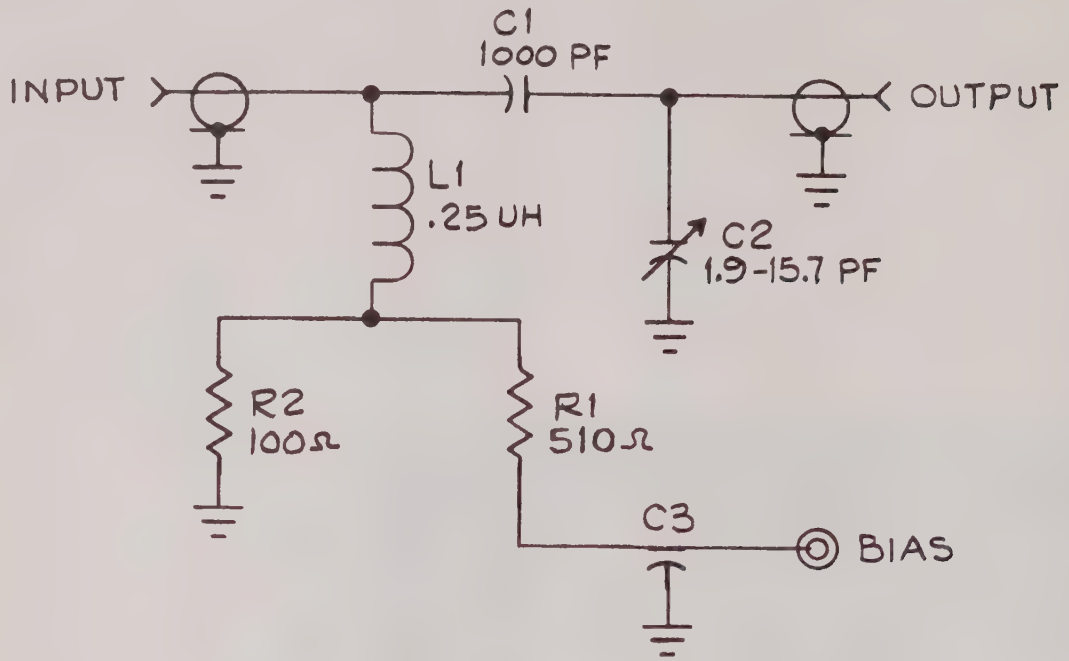
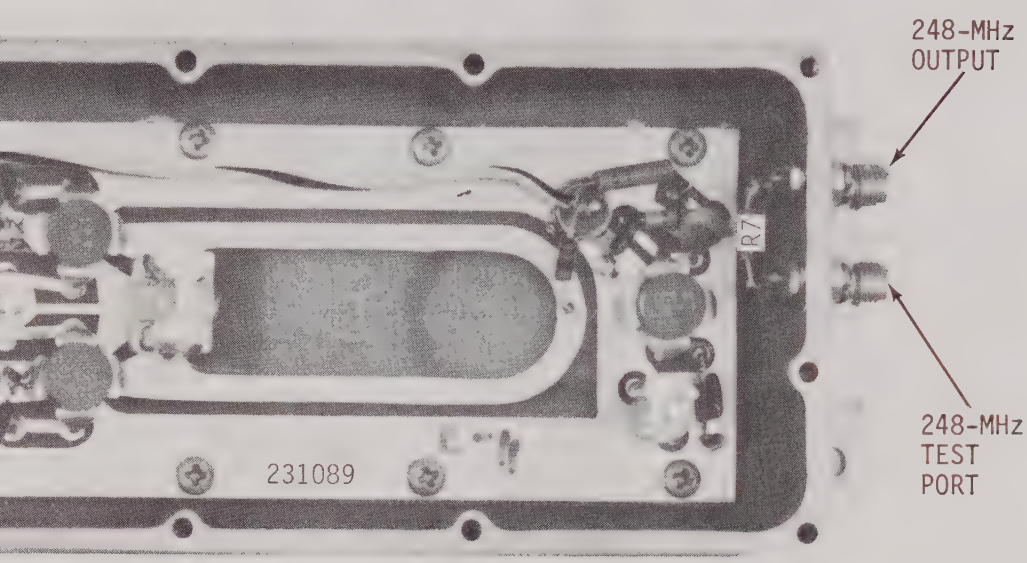
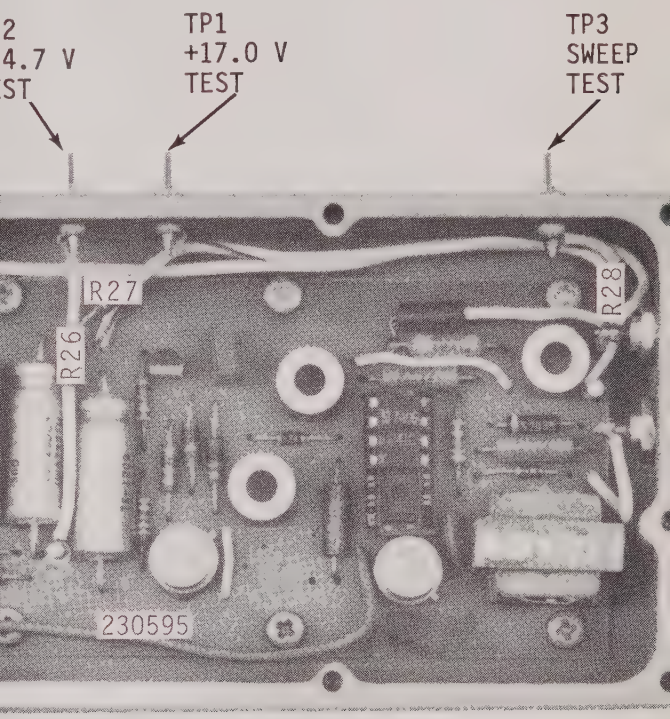


Figure 4-31. Mixer Bias (230500) (Sheet 2 of 2)

MIXER BIAS (230500)

Item	Description	FMC	Part No.
C1	Capacitor, 1000 pF	81349	CK60AW102M
C2	Capacitor, variable 1.9-15.7 pF	74970	187-0109-5
C3	Capacitor, filter	50059	MF204
L1	Inductor, 0.25 μF	00752	115297-1
R1	Resistor, 510, 1/4 W	81349	RC07GF511J
R2	Resistor, 100, 1/4 W	81349	RC07GF101J


248-MHz
OUTPUT
R7
231089
248-MHz
TEST
PORT



ly (230543)

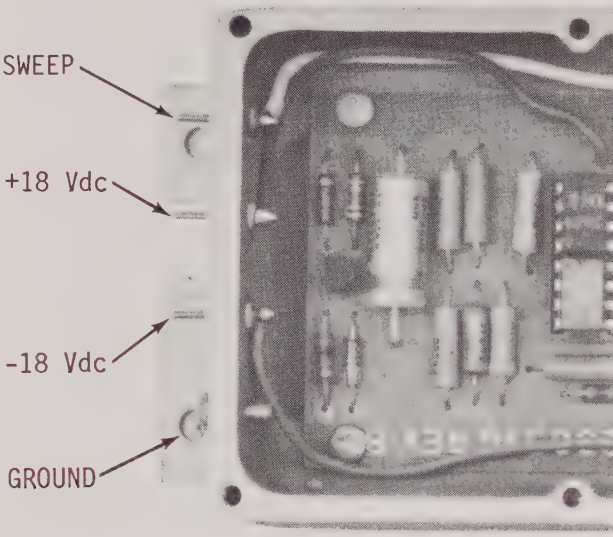


Figure 4-32. LCVCO Assem

LCVCO ASSEMBLY (230543)

Item	Description	FMC	Part No.
C1, C2	Capacitor, filter	50056	MF204
R7	Resistor, 1 k, 1/4 W	81349	RC07GF102J
R26 thru R28	Resistor, 1 k, 1/4 W	81349	RC07GF102J
	VCO Osc. II Board	00752	231089
	VCO Shaper Board	00752	230595

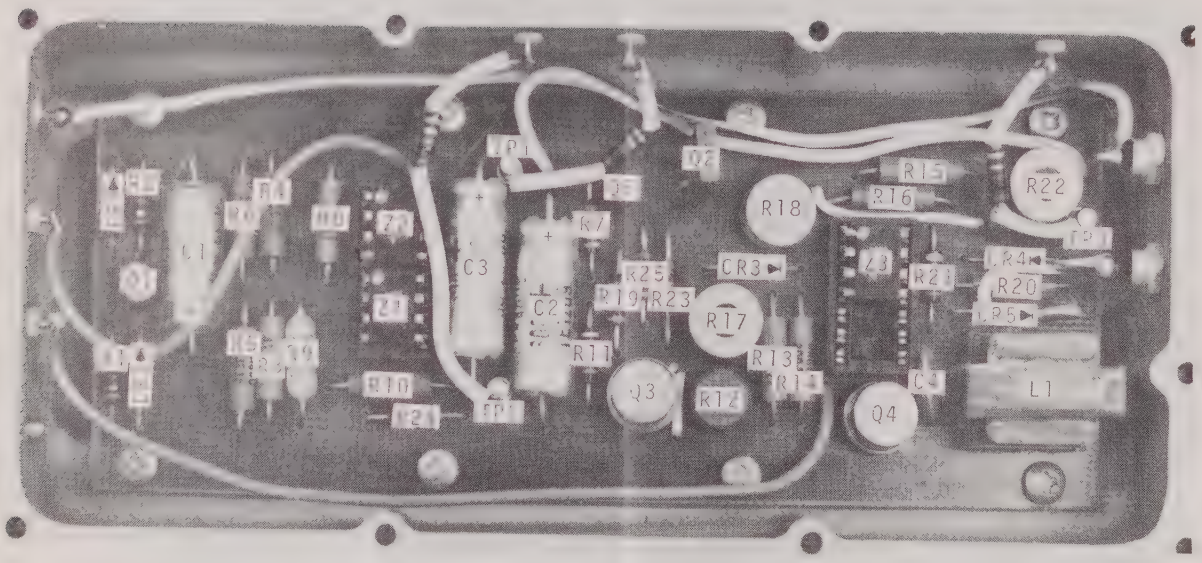


Figure 4-33. LCVCO Shaper Board (230595) (Sheet 1 of 2)

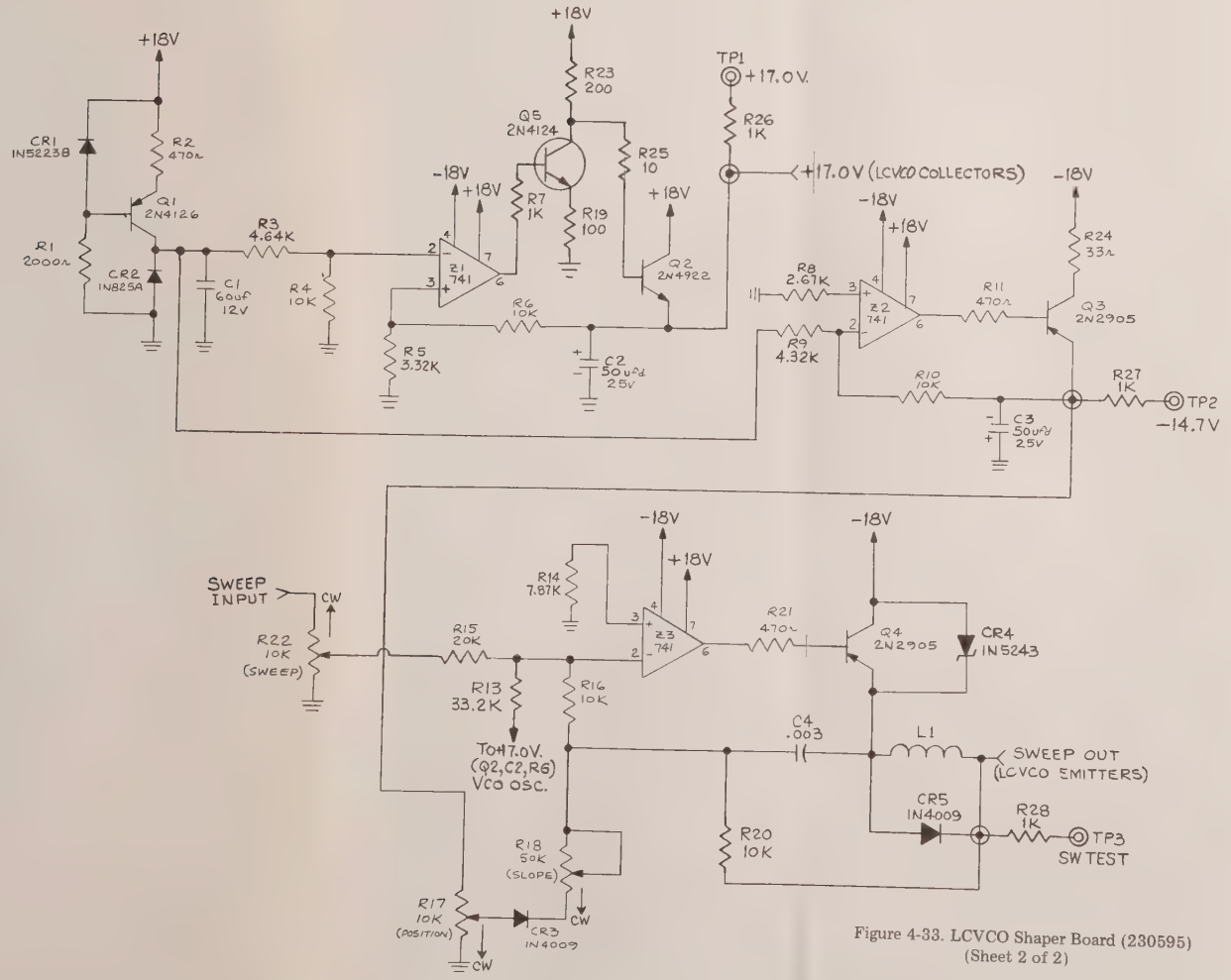


Figure 4-33. LCVCO Shaper Board (230595)
(Sheet 2 of 2)

LCVCO Shaper Board (230595)

Item	Description	FMC	Part No.
C1	Capacitor, 60 μFd, 12 V	56289	TE-1133.5
C2, C3	Capacitor, 50 μF, 25 V	56289	TE-1209
C4	Capacitor, 0.003 μF	71590	DD-302
CR1	Diode	03508	1N5223B
CR2	Diode	05245	1N825A
CR3	Diode	03508	1N4009
CR4	Diode	03508	1N5243
CR5	Diode	03508	1N4009
L1	Inductor	00752	E2409
Q1	Transistor	49956	2N4126
Q2	Transistor	49956	2N4992
Q3, Q4	Transistor	01295	2N2905
Q5	Transistor	04713	2N4124
R1	Resistor, 2 k, 1/4 W	81349	RC07GF202J
R2	Resistor, 470, 1/4 W	81349	RC07GF471J
R3	Resistor, 4.64 k, 1/8 W	81349	RN60C4641F
R4	Resistor, 10 k, 1/8 W	81349	RN60C1002F
R5	Resistor, 3.32 k, 1/8 W	81349	RN60C3321F
R6	Resistor, 10 k, 1/8 W	81349	RN60C1002F
R7	Resistor, 1 k, 1/4 W	81349	RC07GF102J
R8	Resistor, 2.67 k, 1/8 W	81349	RN60C2671F
R9	Resistor, 4.32 k, 1/8 W	81349	RN60C4321F
R10	Resistor, 10 k, 1/8 W	81349	RN60C1002F
R11	Resistor, 470, 1/4 W	81349	RC07GF471J
R12	Resistor, variable, 10 k	80294	3339P-1-103
R13	Resistor, 33.2 k, 1/8 W	81349	RN60C3322F
R14	Resistor, 7.87 k, 1/8 W	81349	RN60C7871F
R15	Resistor, 20 k, 1/8 W	81349	RN60C2002F
R16	Resistor, 10 k, 1/8 W	81349	RN60C1002F
R17	Resistor, variable, 10 k	01121	SV2031
R18	Resistor, variable, 50 k	01121	SV5031
R19	Resistor, 100, 1/4 W	81349	RC07GF101J
R20	Resistor, 10 k, 1/8 W	81349	RN60C1002F
R21	Resistor, 470, 1/4 W	81349	RC07GF471J
R22	Resistor, variable, 10 k	01121	SV1031
R23	Resistor, 200, 1/4 W	81349	RC07GF201J
R24	Resistor, 33, 1/4 W	81349	RC07GF330J
R25	Resistor, 10, 1/4 W	81349	RC07GF100J
Z1 thru Z3	IC	01298	SN72741P

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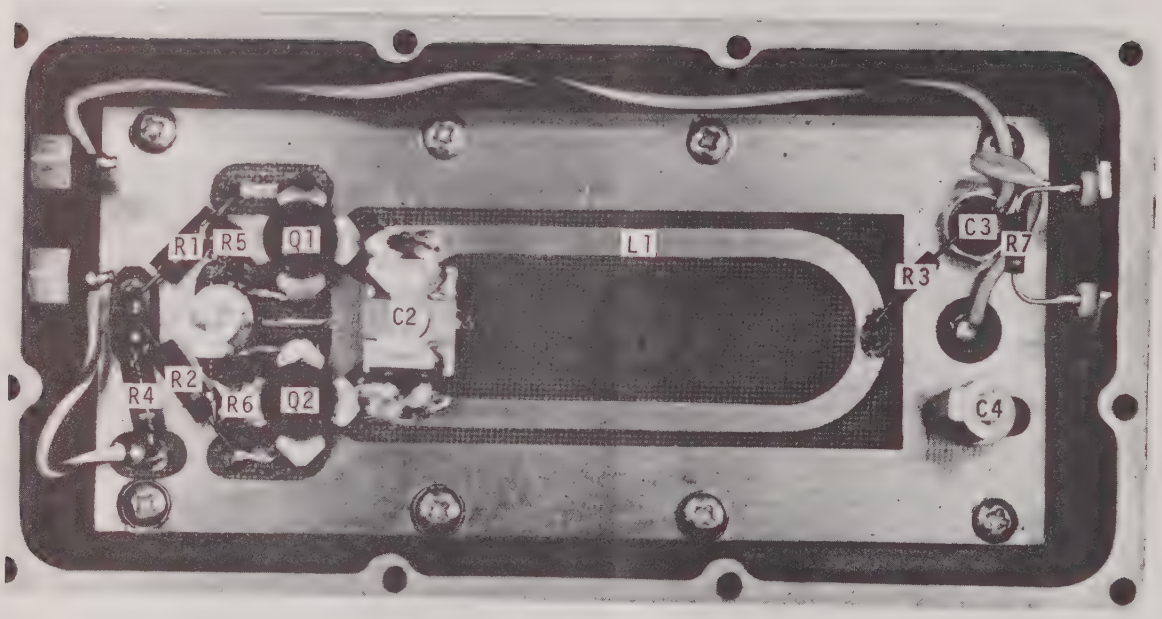


Figure 4-34. LCVCO Oscillator II Board (230532) (Sheet 1 of 2)

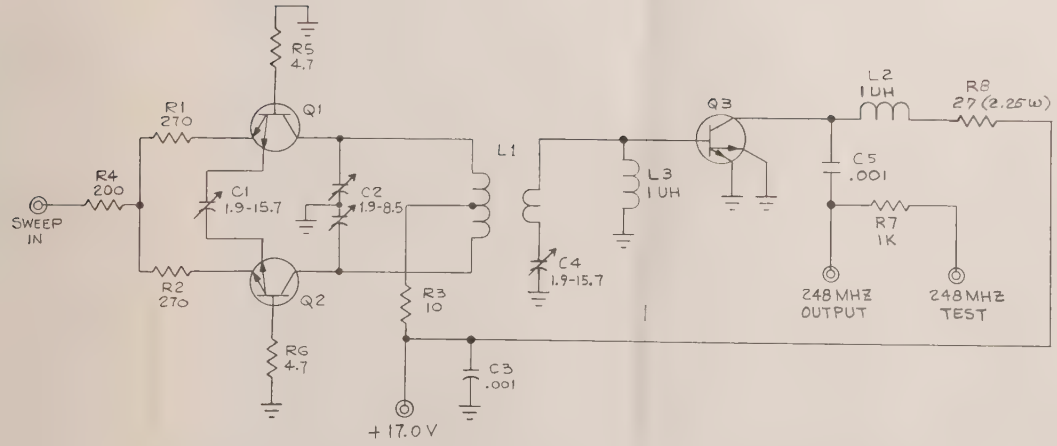


Figure 4-34. LCVCO Oscillator II Board (230532) (Sheet 2 of 2)

LCVCO OSCILLATOR II BOARD (230532)

Item	Description	FMC	Part No.
C1	Capacitor, variable, 1.9-15.7 pF	74970	187-0109-5
C2	Capacitor, variable, 1.9-8.5 pF	74970	189-253-5
C3	Capacitor, standoff, 1000 pF	01121	SS5D-102W
C4	Capacitor, variable, 1.9-15.7 pF	74970	187-0109-5
C5	Capacitor, 1000 pF	81349	DD102
L1	Not used		
L2, L3	Inductor, 1 μH	71895	1025-20
Q1 thru Q3	Transistor	00752	230541-1
R1, R2	Resistor, 270, 1/2 W	81349	RC20GF271J
R3	Resistor, 10, 1/4 W	81349	RC07GF100J
R4	Resistor, 200, 1/2 W	81349	RC20GF201J
R5, R6	Resistor, 4.7, 1/8 W	81349	RC05GF4R7J

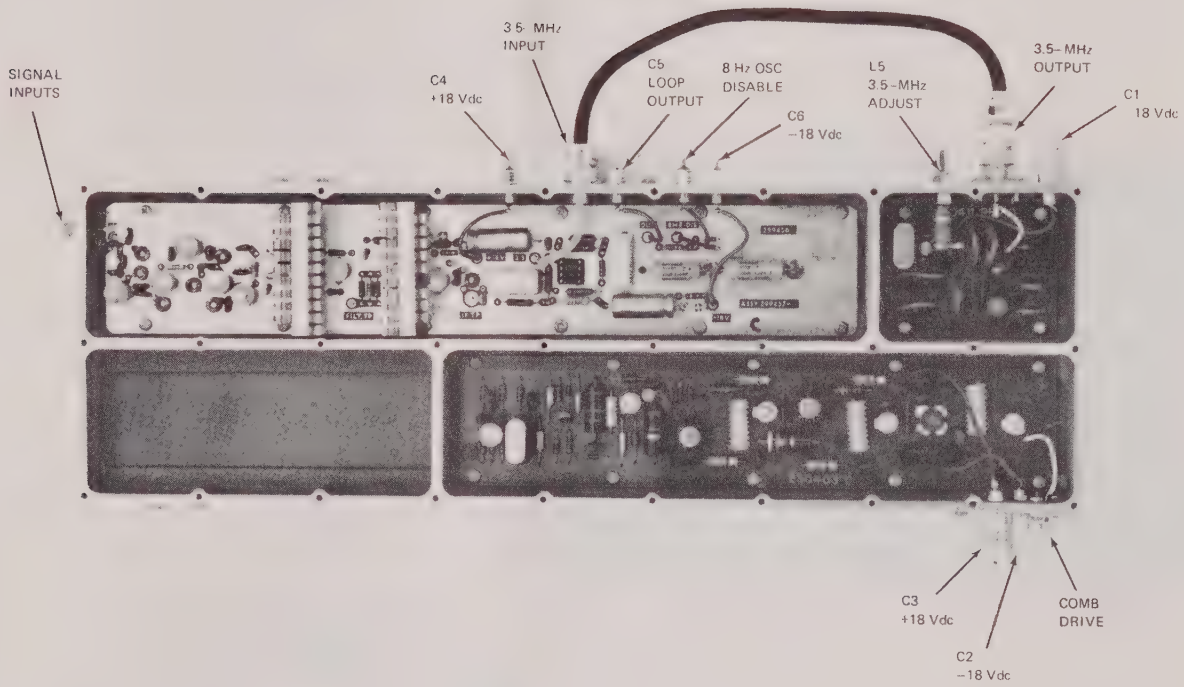


Figure 4-35. Loop Assembly (299375)

LOOP ASSEMBLY (299375)

Item	Description	FMC	Part No.
C1 thru C4	Capacitor, filter	50056	MF204
C5 thru C7	Capacitor, filter	72982	1215-094
L5	Coil, variable, modified	00752	231075
	Comb Source Board	00752	230402
	Loop Control Board	00752	299457
	3.5 MHz Oscillator Board	00752	230410

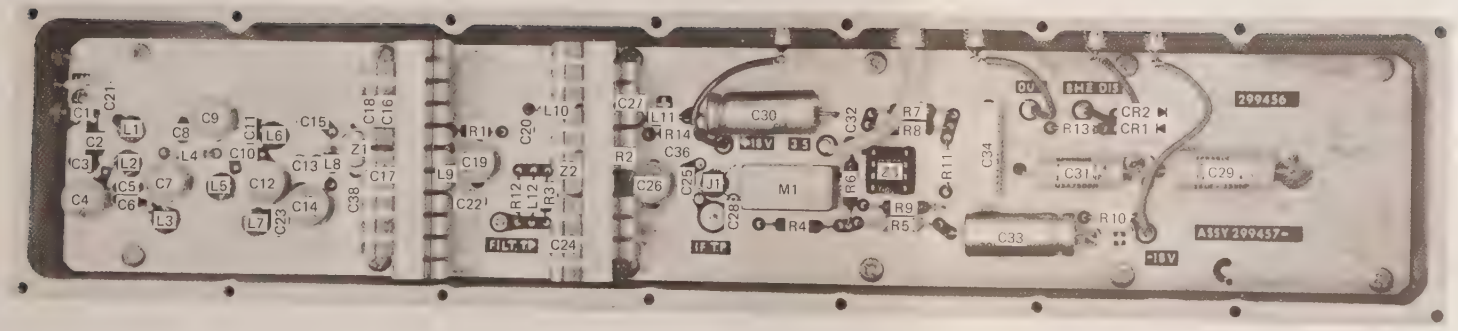
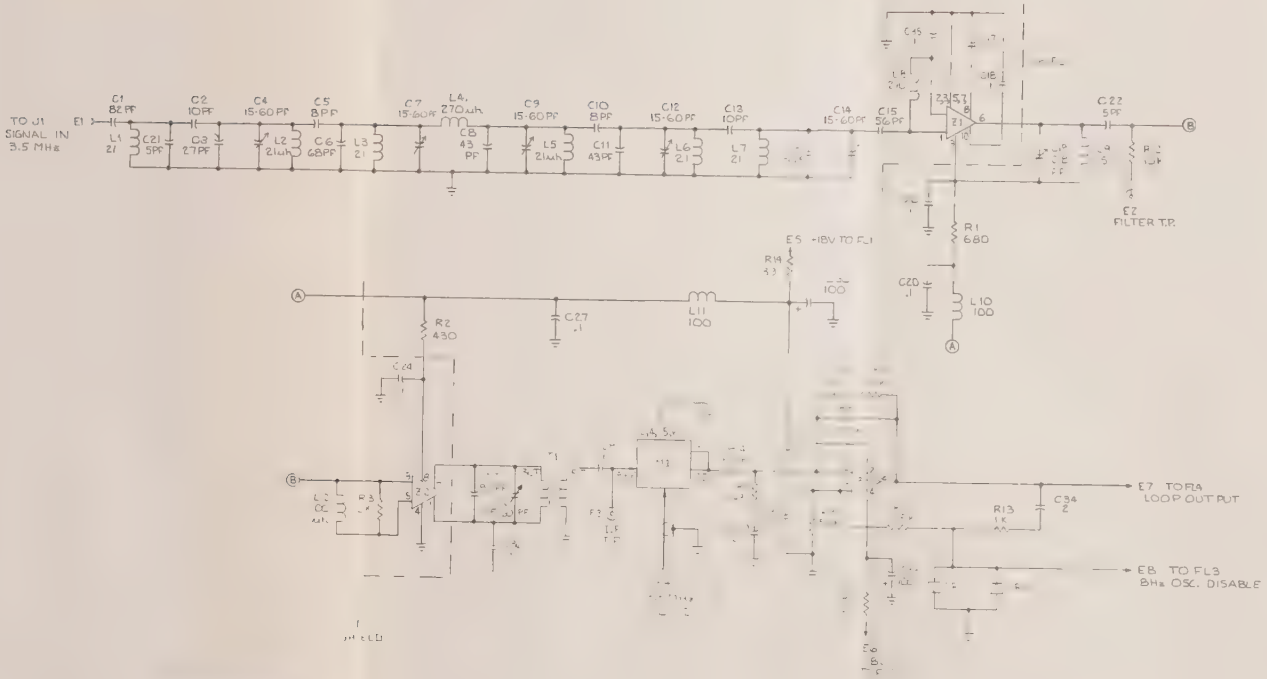


Figure 4-37. Loop Control Board (299457) (Sheet 1 of 2)



HIGHEST REFERENCE DESIGNATIONS			
	R2	L12	M1
R4	T	Z3	
REF. DES. OMITTED			

NOTES:
1) Z1 - MC1550G
Z2 - U5D770339X
Z3 - SN72741P
M1 - 231104-1
T1 - 230531-2
CR1, CR2-230542-1
2 UNLESS OTHERWISE SPECIFIED
ALL CAPACITORS ARE IN UFD.,
RESISTORS ARE IN Ω,
AND INDUCTORS ARE IN uH.

Figure 4-37. Loop Control Board (299457) (Sheet 2 of 2)

COMB SOURCE BOARD (230471-2)

Item	Description	FMC	Part No.
C1	Capacitor, 0.01 μF	56289	5HKS-S10
C2 thru C4	Capacitor, 2.2 μF	56289	CS13BD225K
C5	Capacitor, 100 pF	71590	DD-101
C6	Capacitor, 50 pF	71590	DD-500
C7	Capacitor, 2.2 μF	56289	CS13BE225K
C8	Capacitor, 50 pF	71590	DD-500
C9	Capacitor, 100 pF	71590	DD-101
C10 thru C13	Capacitor, 0.001 μF		CK60AW102M
C14	Capacitor, variable, 1.9-15.7 pF	74970	187-0109-5
C15 thru C18	Capacitor, 0.001 μF		CK60AW102M
C19	Capacitor, variable, 1.9-15.7 pF	74970	187-0109-5
C20 thru C24	Capacitor, 0.001 μF		CK60AW102M
C25	Capacitor, variable, 1.9-15.7 pF	74970	187-0109-5
CR1	Crystal, 2 MHz	00752	230479-3
CR2, CR3	Diode	00752	230542-1
CR4	Diode	00752	230542-2
L1	Inductor, 3 μH	97469	115297-4
L2, L3	Inductor, 100 μH	04072	70F104A1
L4	Inductor, 1.1 μH	97469	115297-3
L5	Inductor, fixed	97469	230529-1
L6, L7	Inductor, 1.1 μH	97469	115297-3
L8	Inductor, fixed	97469	230529-1
L9	Inductor, 1.1 μH	97469	115297-3
L10	Inductor, fixed	00752	230529-1
L11	Inductor, 0.25 μH	00752	115297-1
Q1, Q2	Transistor	04713	2N4124
Q3	Transistor	49956	2N4126
Q4 thru Q6	Transistor	00752	230541-2
Q7	Transistor	00752	230541-1
R1	Resistor, 3.9 k, 1/4 W	81349	RC07GF392J
R2	Resistor, 6.2 k, 1/4 W	81349	RC07GF622J
R3	Resistor, 1 k, 1/4 W	81349	RC07GF102J
R4	Resistor, 270, 1/4 W	81349	RC07GF271J
R5	Resistor, 3.9 k, 1/4 W	81349	RC07GF392J
R6	Resistor, 6.2 k, 1/4 W	81349	RC07GF522J
R7	Resistor, 10, 1/4 W	81349	RC07GF100J
R8	Resistor, 5.1 k, 1/4 W	81349	RC07GF512J
R9	Resistor, 10, 1/4 W	81349	RC07GF100J
R10	Resistor, 2 k, 2 W	81349	RC42GF202J
R11	Resistor, 16 k, 1/4 W	81349	RC07GF163J
R12	Resistor, 51, 1/4 W	81349	RC07GF51QJ
R13	Resistor, 1 k, 2 W	81349	RC42GF102J
R14	Resistor, 100, 1/2 W	81349	RC20GF101J

COMB SOURCE BOARD (230471-2) (cont)

Item	Description	FMC	Part No.
R15	Resistor, 51, 1/4 W	81349	RC07GF510J
R16	Resistor, 470, 2 W	81349	RC42GF471J
R17	Resistor, 47, 1/2 W	81349	RC20GF470J
R18	Resistor, 51, 1/4 W	81349	RC07GF510J
R19	Resistor, 200, 5 W, 5%	09969	RS-5
R20	Resistor, 20, 1/2 W	81349	RC20GF200J

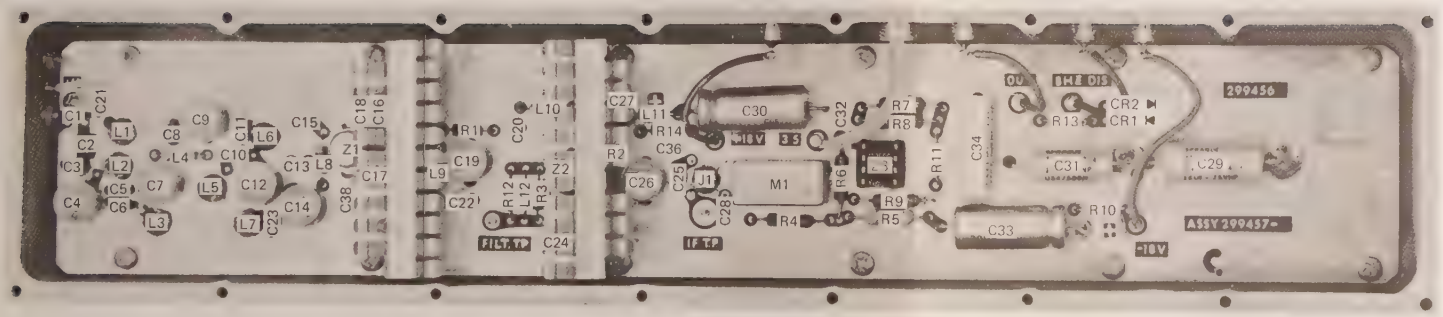
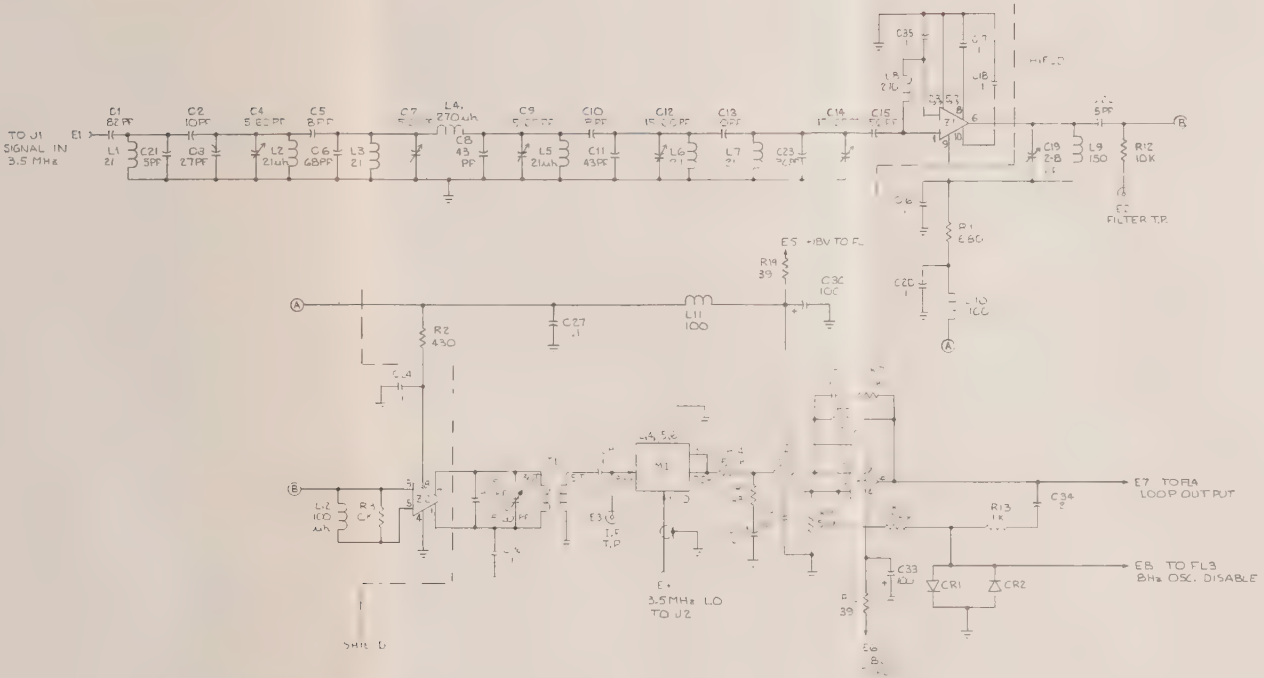


Figure 4-37. Loop Control Board (299457) (Sheet 1 of 2)



NOTES:
1) Z1 - MC1550G
Z2 - USD770330X
Z3 - SN72741P
M1 - 231104-1
T1 - 230531-2
CR1, CR2-230542-1
2 UNLESS OTHERWISE SPECIFIED ALL CAPACITORS ARE IN UFD., RESISTORS ARE IN Ω, AND INDUCTORS ARE IN uH.

Figure 4-37. Loop Control Board (299457) (Sheet 2 of 2)

LOOP CONTROL BOARD (299457)

Item	Description	FMC	Part No.
C1	Capacitor, 82 pF, ±5%	00752	299241-820
C2	Capacitor, 10 pF, ±5pF	00752	299241-100
C3	Capacitor, 27 pF, ±5%	00752	299241-270
C4	Capacitor, variable, 15-60 pF	72982	538-011F15-60
C5	Capacitor, 8 pF, ±.5 pF	00752	299241-080
C6	Capacitor, 68 pF, ±5%	00752	299241-680
C7	Capacitor, variable, 15-60 pF	72982	538-011F15-60
C8	Capacitor, 43 pF, ±5%	00752	299241-430
C9	Capacitor, variable, 15-60 pF	72982	538-011F15-60
C10	Capacitor, 8 pF, ±5 pF	00752	299241-080
C11	Capacitor, 43 pF, ±5%	00752	299241-430
C12	Capacitor, variable, 15-60 pF	72982	538-011F15-60
C13	Capacitor, 10 pF, ±5 pF	00752	299241-100
C14	Capacitor, variable, 15-60 pF	72982	538-011F15-60
C15	Capacitor, 56 pF	00752	299241-560
C16	Capacitor, 0.1 uF	00752	299245-1
C17	Capacitor, 0.1 μF	00752	299245-1
C18	Capacitor, 0.1 μF	00752	299245-1
C19	Capacitor, variable, 2-8 pF	72982	538-011F15-60
C20	Capacitor, 0.1 μF	00752	299245-1
C21	Capacitor, 1 pF, ±.5 pF	00752	299241-050
C22	Capacitor, 5 pF, ±.5 pF	00752	299241-050
C23	Capacitor, 36 pF, ±5%	00752	299241-360
C24	Capacitor, 0.1 μF	00752	299241-820
C25	Capacitor, 82 pF, ±5%	00752	299241-820
C26	Capacitor, variable, 15-60 pF	72982	538-011F15-60
C27	Capacitor, 0.1 μF	00752	299245-1
C28	Capacitor, 0.1 μF	00752	299245-1
C29	Capacitor, 16 μF	56289	TVAN1204.3
C30	Capacitor, 100 μF, 25 V	56289	TE-1211
C31	Capacitor, 10 μF	56289	TVAN11124
C32	Capacitor, 0.01 μF	00752	299245-2
C33	Capacitor, 100 μF, 25 V	56289	TE-1211
C34	Capacitor, 2 μF, 50 V	14099	22W-A205
C35	Capacitor, 0.1 μF	00752	299245-1
C36	Capacitor, 0.1 μF	00752	299245-1
CR1	Diode	150436	5082-2301
CR2	Diode	50436	5082-2301
L1	Inductor, 21 μH	00752	230531-4
L2	Inductor, 21 μH	00752	230531-4
L3	Inductor, 21μH	00752	230531-4
L4	Inductor, 270 μH, ±10%	71895	1025-78
L5	Inductor, 21 μH	00752	230531-4
L6	Inductor, 21 μH	00752	230531-4
L7	Inductor, 21 μH	00752	230531-4
L8	Inductor, 270 μH, ±10%	71895	1025-78

LOOP CONTROL BOARD (299457) (cont)

Item	Description	FMC	Part No.
L9	Inductor, 150 μH, ±10%	71895	1025-72
L10	Inductor, 100 μH	00472	70F104A1
L11	Inductor, 100 μH	00472	70F104A1
L12	Inductor, 100 μH, ±10%	71895	1025-68
M1	Mixer, Double balanced	00752	231104-1
R1	Resistor, 680, 1/4 W, 5%	81349	RC07GF681J
R2	Resistor, 430, 1/4 W, 5%	81349	RC07GF431J
R3	Resistor, 10 k, 1/4 W, 5%	81349	RC07GF103J
R4	Resistor, 5.11 k, 1/8 W, 1%	81349	RN60CS111F
R5	Resistor, 243, 1/8 W, 1/	81349	RN60C2430F
R6	Resistor, 5.11 k, 1/8 W, 1/	81349	RN60C5111F
R7	Resistor, 2 k, 1/8 W, 1%	81349	RN60C2001F
R8	Resistor, 100 k, 1/8 W, 1%	81349	RN60C1003F
R9	Resistor, 5.11 k, 1/8 W, 1%	81349	RN60CS111F
R10	Resistor, 39, 1/4 W, 5%	81349	RC07GF390J
R11	Resistor, 7.5 k, 1/4 W, 5%	81349	RC07GF752J
R12	Resistor, 10 k, 1/4 W, 5%	81349	RC07GF103J
R13	Resistor, 1 k, 1/4 W, 5%	81349	RC07GF102J
R14	Resistor, 39, 1/4 W, 5%	81349	RC07GF-390J
T1	Transformer	00752	230531-2
Z1	Integrated Circuit	04713	MC1550G
Z2	Integrated Circuit	07263	US0770339X
Z3	Integrated Circuit	01295	SN72741P

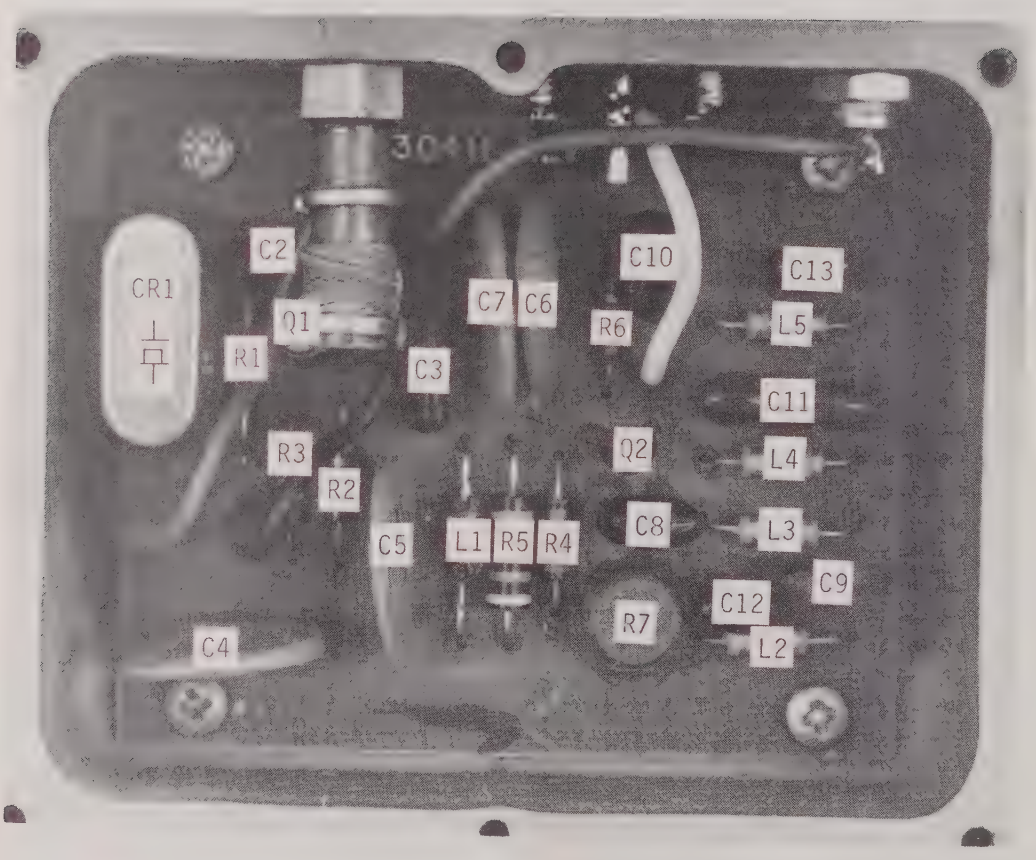


Figure 4-38. 3.5-MHz Oscillator (230410) (Sheet 1 of 2)

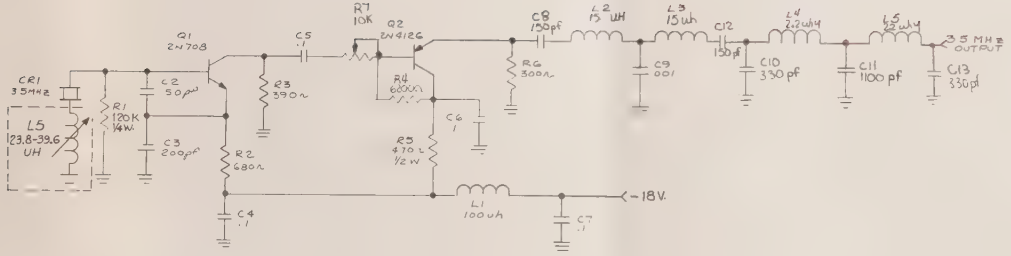


Figure 4-38. 3.5-MHz Oscillator Board (230410)
(Sheet 2 of 2)

3.5 MHz OSCILLATOR BOARD (230410)

Item	Description	FMC	Part No.
C1	Not used		
C2	Capacitor, 150 pF ±10%	72136	DM-15-151K
C3	Capacitor, 200 pF ±10%	72136	DM-15-201K
C4 thru C7	Capacitor, 0.1 μF, 75 V	71599	DDA-104
C8	Capacitor, 150 pF	81349	CM04FD-151-J03
C9	Capacitor, 0.001 μF	81349	CK60AW102M
C10	Capacitor, 330 pF	81349	CM04FD-331-J03
C11	Capacitor, 1100 pF	81349	CM06FD-112-J03
C12	Capacitor, 150 pF	81349	CM04FD-151-J03
C13	Capacitor, 330 pF	81349	CM04FD-331-J03
CR1	Crystal, 3.5 MHz	00752	230479-4
L1	Inductor, 100 μH	04072	70F104A1
L2, L3	Inductor, 15 μH	71895	1025-48
L4, L5	Inductor, 2.2 μH	71895	1025-28
Q1	Transistor	04713	2N708
Q2	Transistor	49956	2N4126
R1	Resistor, 120 k, 1/4 W	81349	RC07GF124J
R2	Resistor, 680, 1/4 W	81349	RC07GF681J
R3	Resistor, 390, 1/4 W	81349	RC07GF391J
R4	Resistor, 6.2 k, 1/4 W	81349	RC07GF622J
R5	Resistor, 470, 1/2 W	81349	RC20GF471J
R6	Resistor, 300, 1/4 W	81349	RC07GF301J
R7	Resistor, variable, 10 k	80294	3339P-1-103

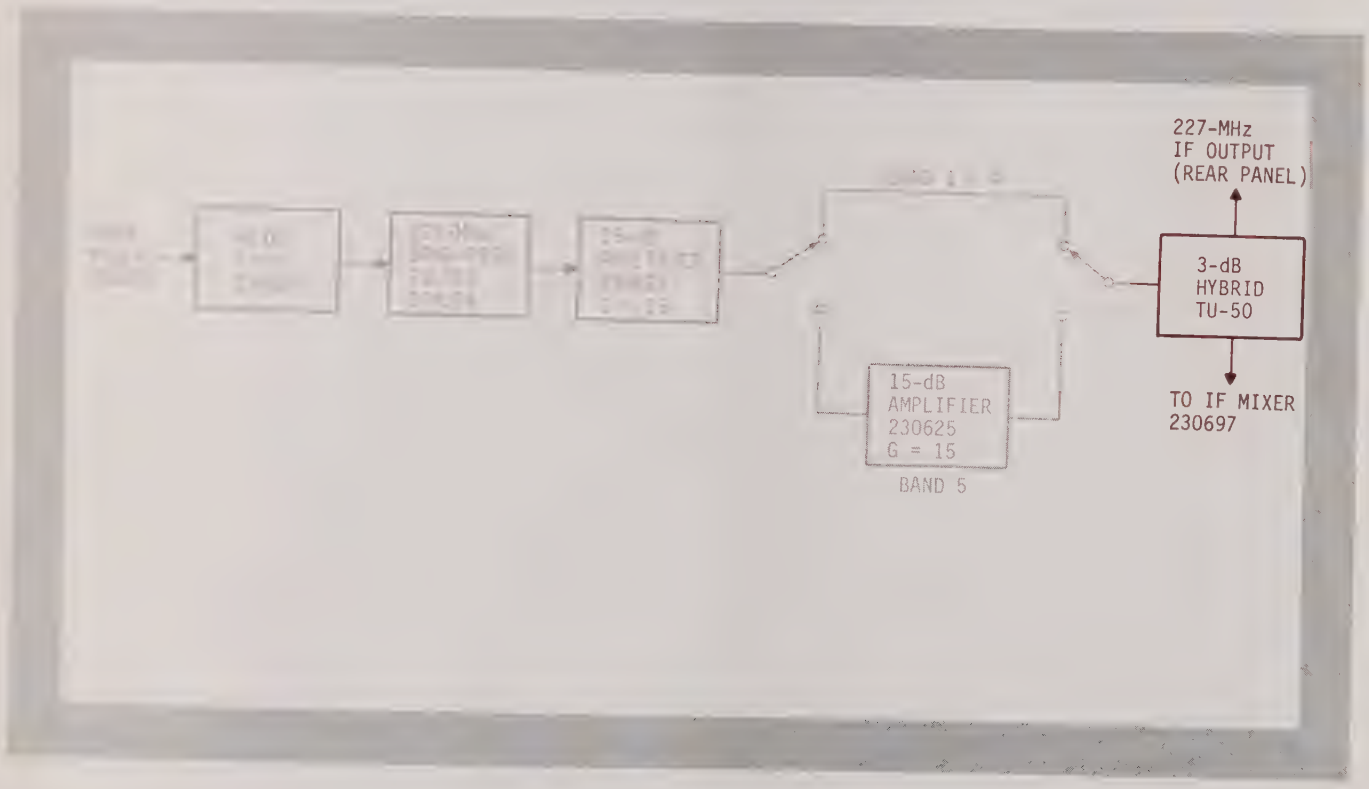
For information on the display unit, refer to the applicable display manual.

APPENDIX

OPTIONAL FEATURES

002 OPTION

The 002 Option is available to provide a wider bandwidth for analysis and receiver applications. The 227-MHz IF signal is brought out with a 10-MHz bandwidth at the rear panel. The output is fixed-tuned when the AILTECH 727 Spectrum Analyzer is placed in the time domain mode or at a scan width of less than 1 MHz per division. The simplified block diagram of the 002 Option is shown below with a table of the typical conversion loss as a function of Band.

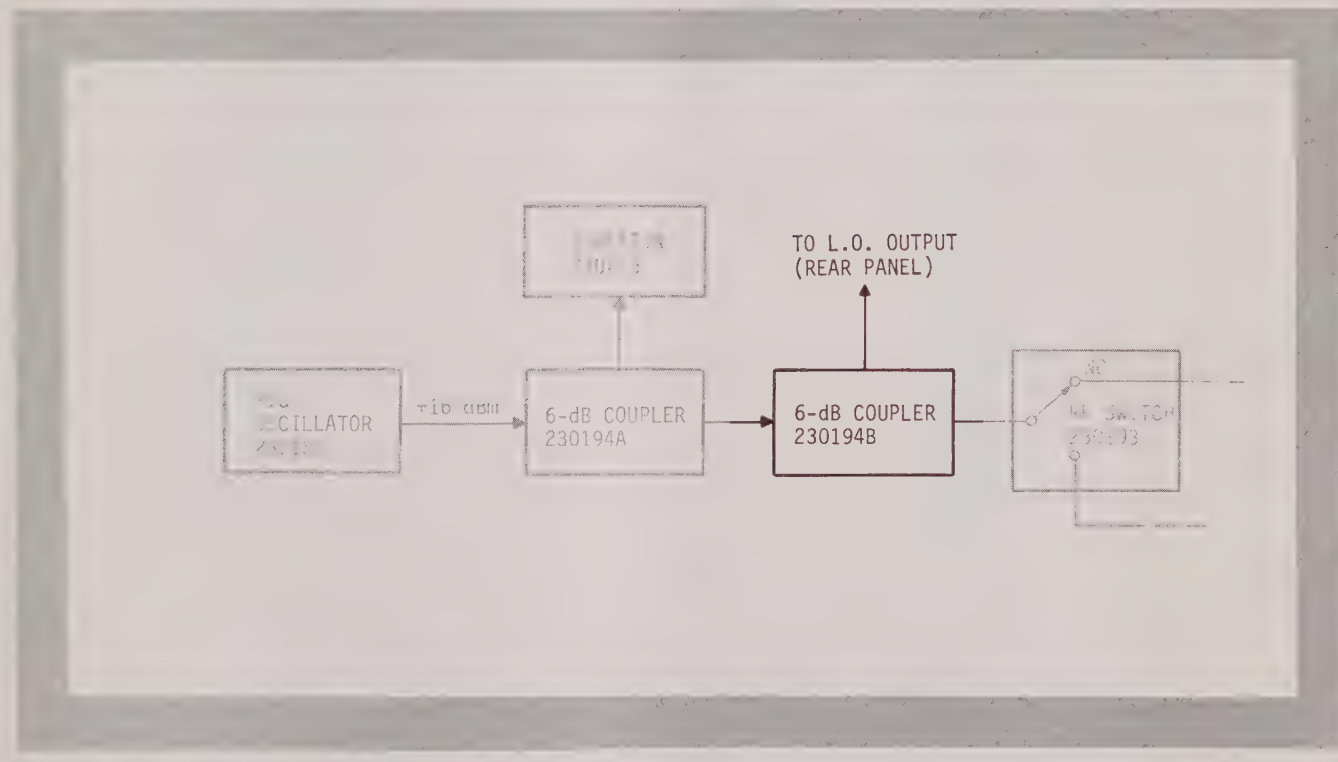


Typical conversion losses/gains from front to rear panel output at 227 MHz.

Band	
1	+10 db Gain
2	8 db Loss
3	14 db Loss
4	20 db Loss
5	10 db Loss

003 OPTION

The 003 Option provides access to the first local oscillator out of the 727. This is done by placing a 6-dB directional coupler in series with the YIG local oscillator and tapping off the coupled-down port. This signal is made available for use as a sweeping signal from 1.7 to 4.3 GHz or to permit highly accurate frequency measurements. The power out at the LO output of the rear panel is typically +5 dbm. The simplified block diagram of the 003 Option is shown below.



727-45 Option

A Rack Mount is available for all 727 models. The rack mount consists of two right angle side plates and spacing shims for the slides.

RECOMMENDED SPARE PARTS FOR 727 SERIES SPECTRUM ANALYZER

Part Name	Part No.
Sweep Generator	230216
Bias Interface Board	299344
Pre-Amp Board	230480
Digital Display Board	299468
IF Assembly	299350
RF Amplifier	230625
Loop Assembly	299375
LCVCO	230543
IF Attenuator	299367
LOG IF	230390
YIG Driver Board	299375
YIG Driver Heat Sink Assy.	299400
L.V. Power Supply	230426-2
R.F. Coaxial Switch	231079
Microwave Mixer	230567
2060 MHz Oscillator	299332
Mixer	230478
Tuner Assembly	299137
YIG Oscillator	230186
YIG Filter	299463
R.F. Attenuator	299330
R.F. Cable	298505-34
R.F. Cable	298505-40
Switch S1	299475
Auto Centering Board	299378
Switch S2	299476
Switch S3	299302

TEKTRONIX®

This insert is provided as a supplement to the instruction manual furnished with this modified instrument. The information given in this insert supersedes that given in the manual

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605

MOD WF

MODIFICATION INSERT

Tektronix, Inc ● P. O. Box 500 ● Beaverton, Oregon 97077 Phone 644-0161 ● Cables: Tektronix

112475

061-1040-00

This manual insert describes the special features of MOD WF as it applies to the Tektronix 605 Storage Monitor. MOD WF replaces the standard CRT with a special 10 x 10 division internal CRT graticule, having the same characteristics as the standard; changes the implosion shield from clear to blue-tinted; shortens the AC power cord to 12 inches; and adds -X, -Y, and -Z inputs via rear-panel REMOTE PROGRAM connector J20.

The following input connections have been added via J20.

Contact	Function	Connection
11	-Y Input	Vert Ampl, inverting input
12	-X Gnd	Horiz Ampl common*
13	-Z Input	Z-Axis, inverting input
23	-Y Gnd	Vert Ampl common*
24	-X Input	Horiz Ampl, inverting input
25	-Z Gnd	Z-Axis common (chassis ground)

*Normally isolated by 47 Ω from chassis ground.

X and Y Gain. Gains of the X and Y amplifiers are initially set for Y 125 mv/div; X 133 mV/div, to facilitate X-Y phase checking.

PARTS LIST

Electrical

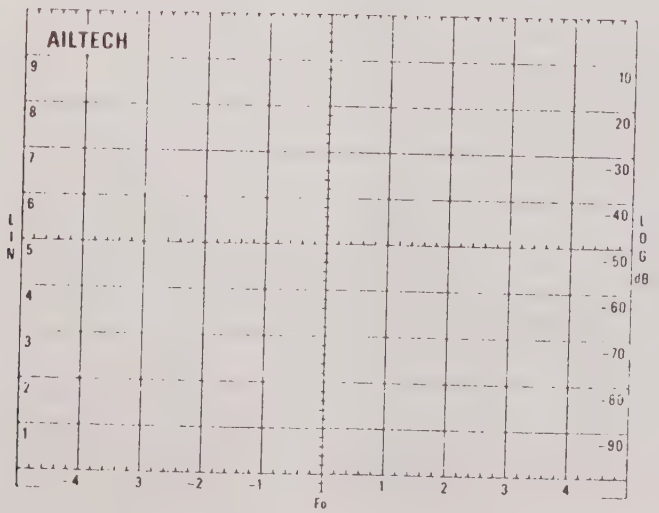
Change:

V100	037-4117-00	1	ELECTRON TUBE, CRT, T7420-401-9.60

Mechanical

Change:

	337-1674-00	1	SHIELD, ELECTRON TUBE, CRT, BLUE-TINTED



Graticule pattern 9.60. Vertical divisions are 0.65 cm; Horizontal divisions are 0.86 cm.

TEKTRONIX®

605 VARIABLE PERSISTANCE STORAGE MONITOR

INSTRUCTION MANUAL

Tektronix, Inc.
P.O. Box 500
Beaverton, Oregon 97005

Serial Number _____

070-1679-00

First Printing MAR 74

WARRANTY

All TEKTRONIX instruments are warranted against defective materials and workmanship for one year. Any questions with respect to the warranty should be taken up with your TEKTRONIX Field Engineer or representative.

All requests for repairs and replacement parts should be directed to the TEKTRONIX Field Office or representative in your area. This will assure you the fastest possible service. Please include the instrument Type Number or Part Number and Serial Number with all requests for parts or service.

Specifications and price change privileges reserved.

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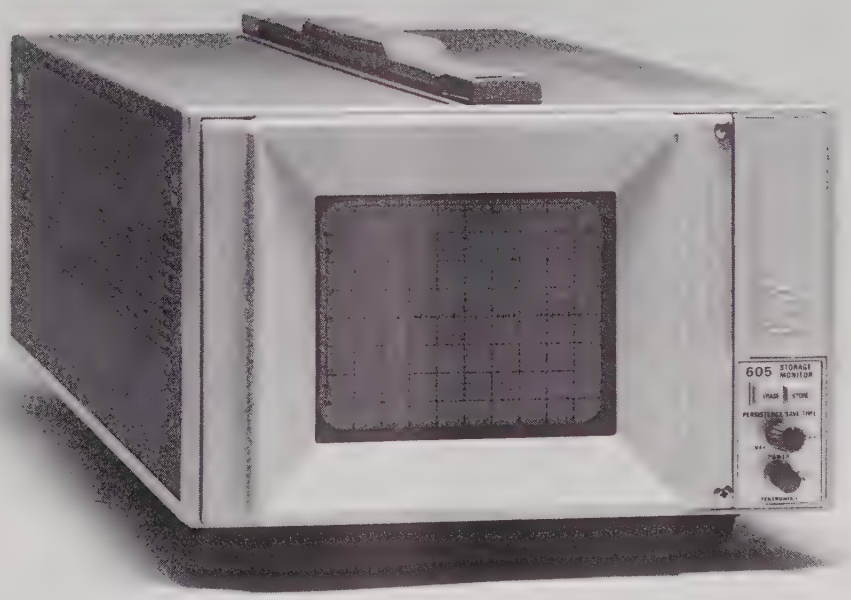

605 STORAGE MONITOR

INSTALLATION

Before you start

1. Check the line voltage indicator for line voltage. Use the bail to raise the front of the instrument.

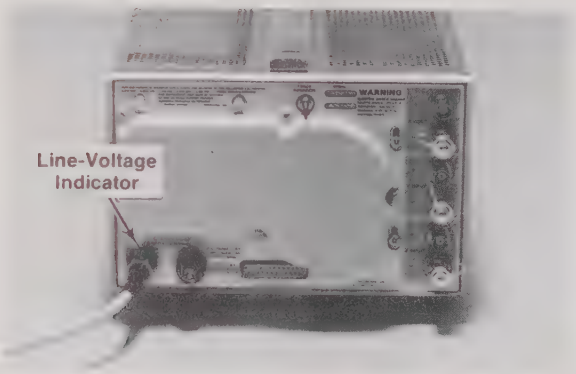


Fig. 1-1. Location of Line-Voltage Indicator showing line voltage that instrument has been set to operate on.

. . . go to Operating Instructions . . .

2. If a change is needed, follow these steps:

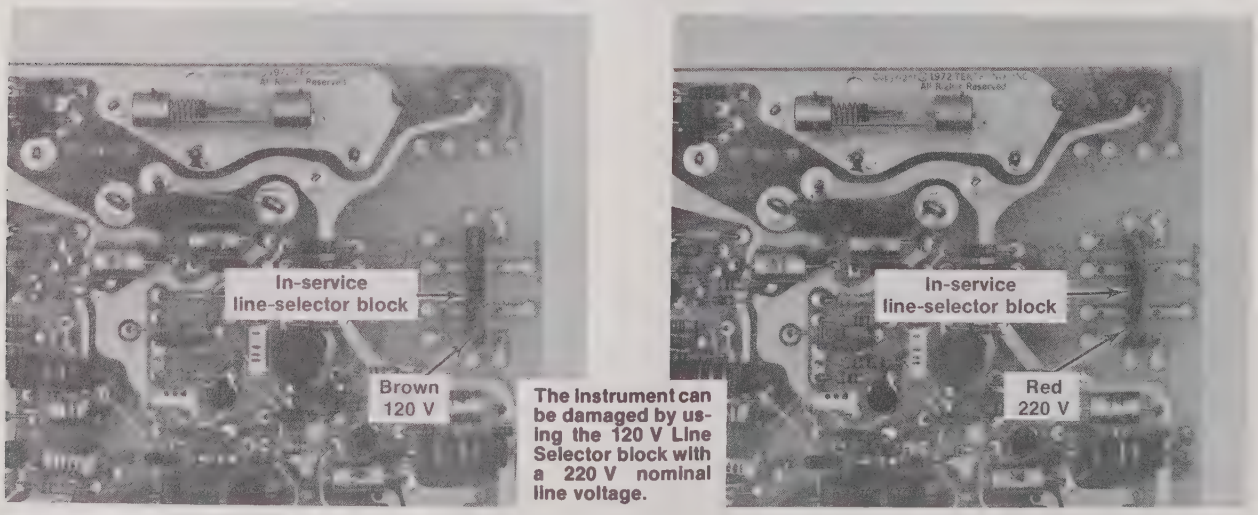


Fig. 1-2. Illustration showing a portion of L.V. power supply circuit board.

a. Line Selector Blocks(s)

Remove the bottom dust cover by removing the two screws and turning the four slotted fasteners a quarter turn counterclockwise. This gives easy access to the Line Selector blocks located on the LV power supply circuit board.

Regulating Ranges for Power Transformer

Line Selector Block Position	Regulating Ranges	
	120 Volts Nominal	220 Volts Nominal
L	90 VAC to 110 VAC	180 VAC to 220 VAC
M	99 VAC to 121 VAC	198 VAC to 242 VAC
H	108 VAC to 132 VAC	216 VAC to 264 VAC
Line Fuse Data	0.5 A slow-blow	0.3 A slow-blow

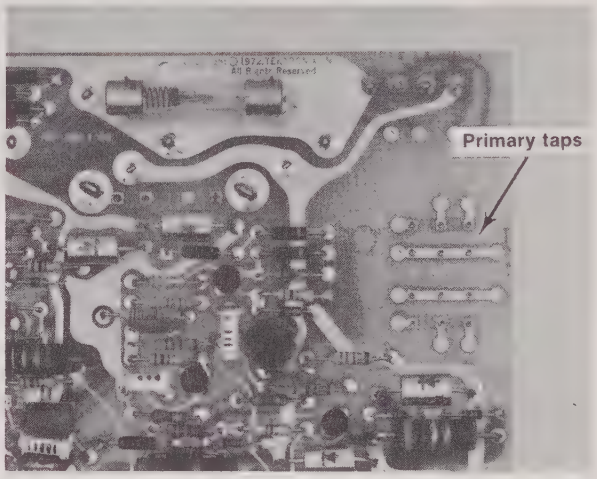


Fig. 1-3. Primary taps area of L.V. power supply circuit board.

b. Line Range Taps

c. Rear Panel

3. Replace the bottom dust cover.

4. If necessary, change the line cord plug to match the power source receptacle or use an adapter.

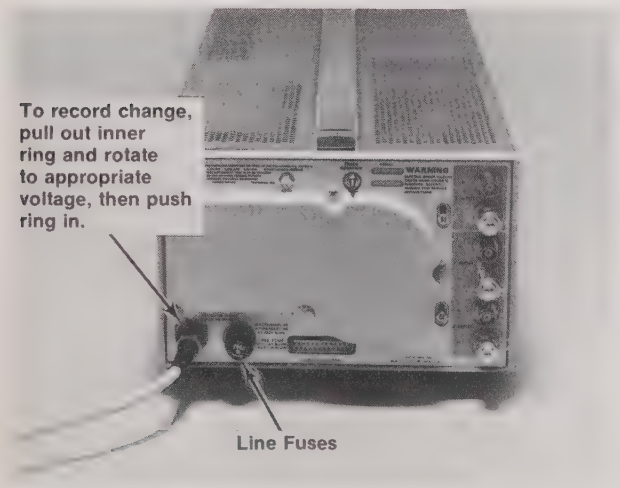


Fig. 1-4. View showing rear-panel.

5. Plug the cord into the power source.

6. Use the bail to raise the front of the instrument.

. . . go to

Operating

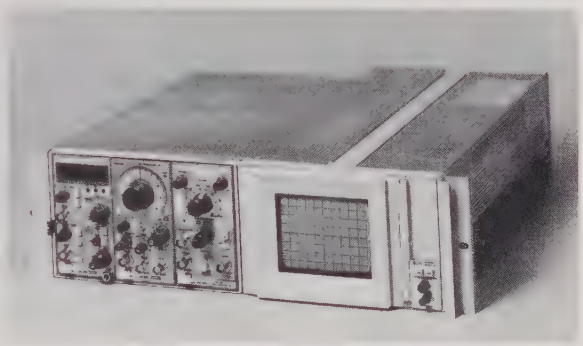
Instructions. . .

INSTRUMENT CONVERSION

CABINET TO RACKMOUNT

TEKTRONIX PART NO. 040-0601-00. This conversion kit is designed to mount one 605 in a standard 19-inch wide rack. The kit is equipped with a slide-out assembly and includes securing hardware and a blank front panel to cover the second instrument opening in the kit.

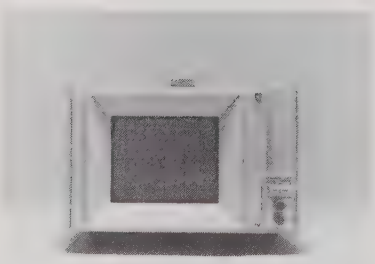
TEKTRONIX PART NO. 040-0600-00. This conversion kit will mount two 605 or a 605 and either a 603 or 604 side-by-side in a standard 19-inch wide rack. The kit comes equipped with a slide-out assembly and includes securing hardware.



TEKTRONIX PART NO. 040-0624-00. This kit is designed to convert one TM 503 and one 605 to mount side-by-side in a standard 19-inch wide rack. The kit is equipped with a slide-out assembly and includes securing hardware.

RACKMOUNT TO CABINET

TEKTRONIX PART NO. 040-0602-00. This conversion kit converts one 605 from a rackmount configuration to a cabinet configuration.



OPERATING INSTRUCTIONS

The 605 Storage Monitor is a fast writing speed X-Y display monitor having variable storage persistence. It provides a bright display of analog data on an 8 x 10 division (0.9 cm/div) area. The 605 is well suited for many display applications in ultrasonic detection systems, electron microscope systems, radiation and thermal scanning systems, speech therapy, mechanical pressure, volume, and vibration analysis, and medical and biophysical systems. The 605 may also be used to provide stored displays of alpha-numeric and graphic information from computers and other data-transmission systems.

All display axes (vertical, horizontal and intensity) can be operated differentially as well as from a single-signal source. A remote-program connector permits the monitor to be operated from a remote station. The 605 storage tube (crt) allows a display to be held in excess of five minutes, depending on the setting of the Operate Level control (longer display times are possible in the 'Save' mode). The monitor can be operated from either a 120-volt or a 220-volt nominal line-voltage source.

BASIC OPERATION

SETUP INFORMATION

NOTE

The PULL TO SAVE switch must be pushed in to permit viewing of either stored or non-stored displays.

1. Pull the POWER switch out to turn the instrument on. After a short delay, with the position controls set to midrange and the PULL TO SAVE switch pushed in, slowly increase the INTENSITY until the spot is visible.

2. Position the spot to the desired starting location. The position controls are located behind the access door, and arrows on the panel adjacent to the knobs indicate the positioning direction.

3. Activate the vertical, horizontal, and z-axis signals and check for proper display. If the vertical or horizontal deflection factor is wrong, those input signals can be adjusted up to about 5X; see General Operating Information in this section. Adjust the FOCUS control for a sharp, well-defined display.

STORAGE OPERATION (VARIABLE PERSISTENCE)

4. Disconnect any vertical, horizontal, or z-axis input signals.

5. Press the STORE button and note that the crt will momentarily be flooded positive.

6. Move the display spot around the crt viewing area with the position controls; a display should be visible, but will fade out within a few seconds. Increase the PERSISTENCE/SAVE TIME control setting (counterclockwise) if a display of longer retention is required. Increase the OPERATE LEVEL to increase the sensitivity to the writing beam (increase writing rate). If there is no display visible increase the INTENSITY control setting and move the display spot around.

7. Press the ERASE button; the crt should turn positive and erase. Move the display spot around on the crt to obtain another stored display on the crt. Pull the PULL TO SAVE switch; the display is stored and no other data or change in position will affect the display. The PULL TO SAVE switch, when pulled, locks out the z-axis, erase circuit and cuts off the current to the flood gun cathode as long as the PERSISTENCE/SAVE TIME control is turned fully counterclockwise (display stored at the maximum time). Turning the PERSISTENCE/SAVE TIME control clockwise will decrease the time a stored display is retained on the crt. When the display is not being used, turn the PERSISTENCE/SAVE TIME control fully counterclockwise (the display will not be visible on the screen); the information has not been lost or destroyed. Turn the PERSISTENCE/SAVE TIME control clockwise until a display is visible when needed.

NOTE

The 605 save time control and the variable persistence control are combined into one control. If the PERSISTENCE/SAVE TIME control has been adjusted to view the display in the 'Save' mode and the 605 is then taken out of the 'Save' mode, the display will fade rapidly since the persistence is not now set for maximum time.

STORAGE OPERATION (WITHOUT VARIABLE PERSISTENCE)

8. Rotate the PERSISTENCE/SAVE TIME control to its fully counterclockwise position and push the PULL TO SAVE switch in.

9. Move the display spot around the crt viewing area with the position controls; a display should be visible. Increase the OPERATE LEVEL to increase the sensitivity to the writing beam (increase writing rate). If there is no display visible, increase the INTENSITY control setting, and move the display spot around.

10. Press the ERASE button and note that the stored display is erased. Another display can be stored by again writing the crt with the display spot.

NOTE

If a bright spot or stationary display is present on the crt viewing area and the OPERATE LEVEL is set to a high level, the crt viewing area will eventually fade positive (screen will be totally bright).

GENERAL OPERATING INFORMATION

SIGNAL CONNECTORS

BNC connectors are provided at the rear of the instrument for application of input signal (either single-ended or differential) to the X and Y deflection amplifiers and to the Z-axis amplifier to control beam intensity. The + inputs for the X and Y deflection amplifiers and the Z-axis amplifier are also connected to the 25-pin remote program connector. As shipped, the instrument is prepared for single-ended inputs; BNC grounding caps are connected to the BNC − inputs. For differential operation, the BNC grounding cap is removed and a signal is applied to both BNC connectors. Also, the BNC connectors can be internally disconnected from ground, permitting a "floating" input. See Electrical Characteristics in Section 3 for differential capability data.

INPUT REQUIREMENTS

The vertical and horizontal deflection factors are set by the factory to a nominal 1 volt for full scale deflection on each axis. Thus the input requirements are 0.125 volt for each division (0.9 cm) of vertical deflection, and 0.1 volt for each division of horizontal deflection. An internal gain control for each deflection amplifier permits an adjustable full-scale range from 0.5 volt or less to 2.5 volts or more, and an internally selectable 5:1 attenuator extends the deflection factor range to 12.5 volts or more for full scale deflection. Best transient response is achieved when the input signals are no larger than needed to provide full screen displays, i.e., severely overdriving inputs will degrade instrument performance. In any case, do not apply a signal with amplitudes exceeding 100 volts to the X or Y inputs.

With no signals applied to the Z INPUT connectors, the intensity of the display is controlled by the front-panel INTENSITY control. The intensity range provided by this control is from no visual intensity (crt beam off) to full bright. To control the intensity with an externally applied signal, set the INTENSITY control to about midrange. An internal gain control permits the Z input requirement for full intensity control to be adjustable from +1 volt or less to +5 volts or more, depending on the exact setting of the INTENSITY control. A zero-volt input cuts off visual intensity when the INTENSITY control is at about midrange. Exercise care in establishing the correct display intensity; a too-high amplitude Z input signal combined with a too-high INTENSITY control setting may increase the beam current above the phosphor-damaging level. Best transient response is achieved when the input signal is no larger than needed to provide maximum intensity change, i.e., severely overdriving input will degrade instrument performance. In any case, do not apply a Z input signal with amplitudes exceeding 100 volts.

INPUT ATTENUATORS

Each X and Y input circuit includes a selectable 1:1 to 5:1 attenuator, which is set for 1:1 operation when shipped from the factory. The switches for selecting 5:1 attenuation are located on the Deflection Amplifier circuit board at the left rear of the instrument; see Fig. 2-1. Remove the left side panel to gain access.

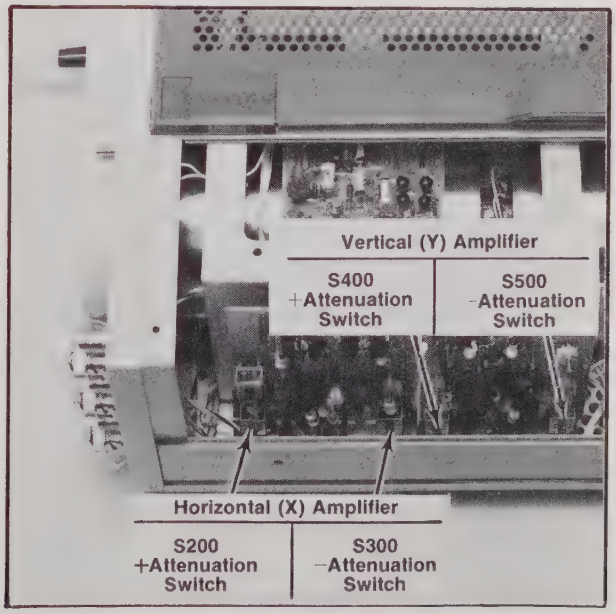


Fig. 2-1. Location of input attenuation switches for the X and Y deflection amplifiers.

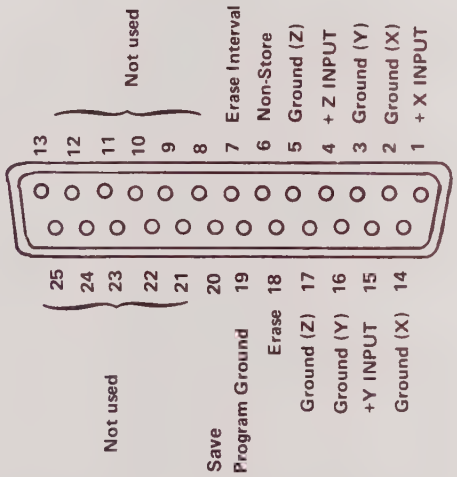
REMOTE PROGRAM CONNECTOR

The Remote Program connector, located on the rear panel, provides direct connections to the + inputs of the X, Y, and Z amplifiers from a remote location. Also, erase, non-store and save storage operation can be controlled from a remote location; however, the front-panel controls of the instrument override the remote inputs. All inputs and outputs are TTL compatible. See Fig. 2-2 for details.

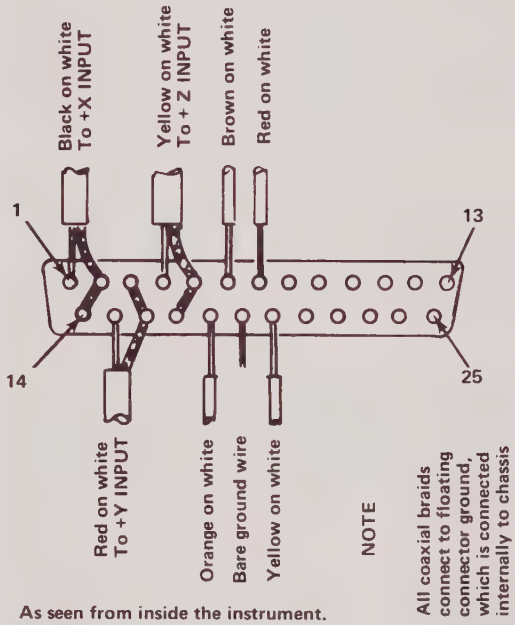
NOTE

Circuit protection requires a logical 0 level of ≤ 0.52 V. This level should be satisfied by the TTL output levels, providing the loading rules of the TTL output device are observed.

REMOTE ERASE. Stored display will be erased when a remote contact is closed to ground, or logical 0 (TTL) is applied.



As seen from the rear panel.



As seen from inside the instrument.

The switching requirements (voltage levels, loading, drive, etc.) of remote-controlled functions can be satisfied by a TTL circuit.

TTL-Compatible Logic Levels:

	VOLTS	CURRENT
Logical 1 =	≤5 V ≥2.4 V	Open Circuit
Logical 0 =	≥0 V ≤0.52 V	1.6 mA

Fig. 2-2. Remote program connector data.

REMOTE NON-STORE. Closing the remote contact to ground or applying a logical 0 (see Fig. 2-2) allows the storage crt to operate in the non-store mode.

REMOTE SAVE. Grounding the remote contact or applying a logical 0 (TTL) places the 605 in the save mode. The front-panel PERSISTENCE/SAVE TIME control sets the save time.

ERASE INTERVAL. During the erase interval, a negative-going pulse, logical 0 (TTL), is present at this contact. This can be used to notify associated equipment that information stored on the 605 crt is being erased.

CARE OF STORAGE SCREEN

The following precautions will prolong the useful storage life of the crt screen used in this instrument.

1. Use the minimum beam intensity required to produce a clear, well-defined display. A too-high beam intensity may permanently damage the crt screen, particularly if a bright spot is allowed to remain stationary on the display area.

2. Avoid repeated use of the same area of the screen. If a particular display is being stored repeatedly, change the vertical position occasionally to use other portions of the display area.

3. Do not leave a stored display on the screen when it is no longer needed.

4. Operate the instrument in the non-store mode unless storage is required.

STORAGE OPERATION

The storage feature greatly increases the versatility of the 605. The storage cathode-ray tube allows a display to be retained for a longer period of time. When the STORE button is out, the instrument operates as a conventional monitor.

When the STORE button is in, the instrument operates in a storage mode. Two modes of storage are available. They are Variable Persistence, where the persistence of the crt is electrically controlled by the PERSISTENCE/SAVE TIME control; and a conventional storage mode, which allows longer retention of the displayed information. When the PULL TO SAVE switch is pulled out, the length of time the stored image can be retained is greatly extended. A lockout function prevents accidental erasure of the stored display in the Save mode.

A stored display is erased by pressing in the ERASE switch. In the Save mode, the erase function is disabled.

SERVICE INFORMATION

Maintenance (consisting of cleaning, visual inspection, etc.) performed on a regular basis, will improve the reliability of the oscilloscope. Periodic checks of the semiconductor devices used in the system are not recommended as a preventive maintenance measure. See semiconductor-checking information given under troubleshooting. A convenient time to perform preventive maintenance is preceding instrument adjustments.

PANEL REMOVAL

WARNING

Disconnect the power before cleaning the unit or replacing parts.

The cabinet panels are held in place by slotted fasteners. To remove the panels, turn each fastener counterclockwise a quarter turn with a large screwdriver, coin, or similar device. Lift the panels away. Operate the unit with its panels in place to protect the interior from dust, and to eliminate shock hazard.

CLEANING

CAUTION

Avoid the use of chemical cleaning agents which might damage plastic parts. Avoid chemicals containing benzene, toluene, xylene, acetone, or similar solvents.

EXTERIOR. Loose dust may be removed with a soft cloth or a dry brush. Water and mild detergent may be used; however, abrasive cleaners should not be used.

INTERIOR. Cleaning the interior of the unit should precede adjustment, since the cleaning process can alter the settings of the adjustments. Use low-velocity compressed air to blow off the accumulated dust. Hardened dirt can be removed with a soft, dry brush, cotton-tipped swab, or cloth dampened with a water and mild detergent solution.

NOTE

Circuit boards and components must be dry before applying power to the instrument.

ADJUSTMENT

To ensure accurate measurements, the performance of the 605 should be checked periodically. Complete adjustment instructions are given later in this manual.

The adjustment procedure can be helpful in isolating major troubles. Moreover, minor troubles not apparent during regular operation may be revealed and corrected during adjustment.

REPAIR

TROUBLESHOOTING AIDS

DIAGRAMS. Circuit diagrams are given on foldout pages in each individual manual. The circuit number and electrical value of each component in this instrument system is shown on the diagrams (see first page with a tab for definition of the reference designators used to identify components in each unit). Each main circuit is assigned a series of component numbers. The portions of the circuits mounted on circuit boards are enclosed with blue lines.

CAM SWITCH CONTACT IDENTIFICATION. Cam switches shown on the diagrams are coded to indicate the position of the contact in the complete switch assembly counting from the front, or knob end of the switch, toward the rear. The contact closure chart given on the diagrams indicates when each contact is closed.

CIRCUIT BOARDS. Illustrations of the circuit boards are shown on the foldouts. These pictures are located near their respective associated schematic diagrams to aid in cross-reference between the diagrams and the circuit board illustrations. Each electrical component on the boards is identified by its circuit number. The circuit boards are also outlined, on the diagrams, with a blue line that shows which portions of the circuit are located on a circuit board.

COMPONENT AND WIRING COLOR CODE. Colored stripes or dots on resistors and capacitors signify electrical values, tolerances, etc., according to the EIA standard color code. Components not color-coded usually have the value printed on the body.

WARNING

This color code applies to leads within the 605 Storage Monitor only. Color code of the ac power cord is:

Black	*Line*
White	*Neutral*
Green with a yellow stripe	*Safety Earth (ground)*

SEMICONDUCTOR LEAD CONFIGURATION. Fig. 3-1 shows the lead configuration of the semiconductor devices used in this instrument.

MULTI-CONNECTOR HOLDERS. The multi-connector holder is keyed with two triangles, one on the holder and one on the circuit board. When a connection is made perpendicular to a circuit board surface, the orientation of the triangle and the slot numbers on the connector holder is determined by the direction of the nomenclature marking (see Fig. 3-2).

TROUBLESHOOTING EQUIPMENT

The following equipment is useful for troubleshooting the 605 Storage Monitor:

SEMICONDUCTOR TESTER

Description: Dynamic-type tester.

Purpose: To test the semiconductors used in this instrument system.

Recommended type: Tektronix Type 576 Transistor Curve Tracer or equivalent.

MULTIMETER

Description: VTVM, 10-megohm input impedance and 0 to 300 volts range, ac and dc; ohmmeter, 0 to 50 megohms. Accuracy, within 3%. Test probes must be insulated to prevent accidental shorting.

Purpose: To check voltages and for general troubleshooting in this instrument system.

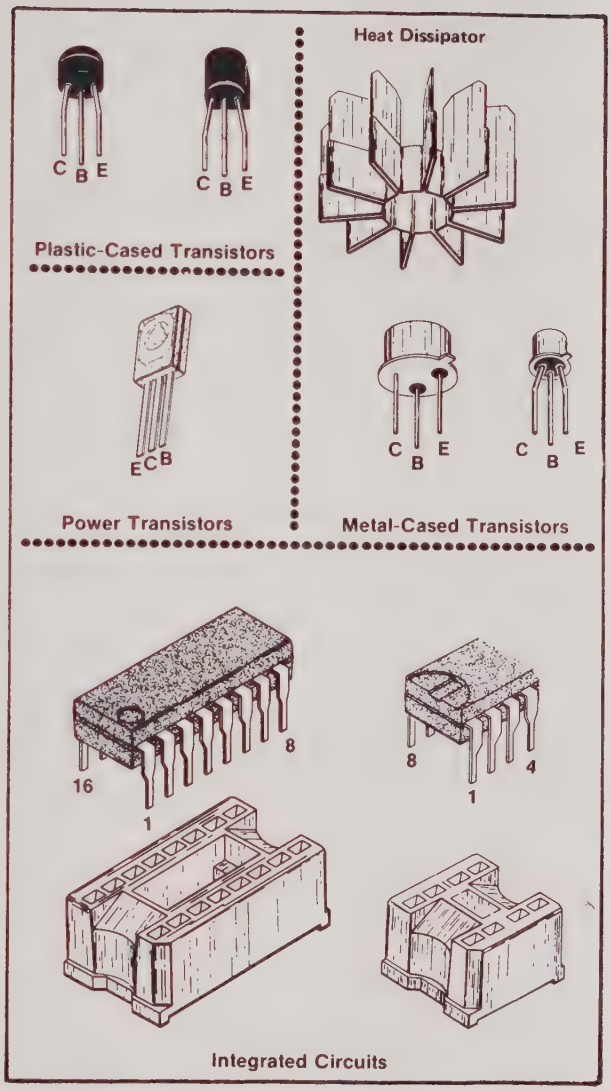


Fig. 3-1. Electrode configuration data for semiconductor devices.

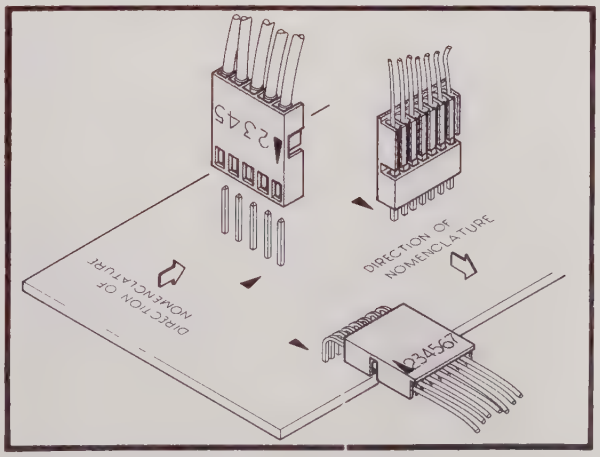


Fig. 3-2. Multi-connector holder orientation.

NOTE

A 20,000 ohms/volts VOM can be used to check the voltages in this instrument if allowances are made for the circuit loading of the VOM at high-impedance points.

TEST OSCILLOSCOPE

Description: Frequency response, dc to 2 megahertz (to 8 megahertz for troubleshooting Z axis amplifier) minimum; deflection factor, 1 millivolt/division to 5 volts/division. A 10X, 10-megohm voltage probe should be used to reduce circuit loading for voltage measurements.

Purpose: To check operating waveforms in this instrument.

TROUBLESHOOTING TECHNIQUES

This troubleshooting procedure is arranged in an order that checks the simple trouble possibilities before proceeding with extensive troubleshooting. When a defective component is located, it should be replaced, following the replacement procedure given under Component Replacement.

CHECK CONTROL SETTINGS. Incorrect control settings can indicate a trouble that does not exist. If there is any question about the correct function or operation of any control, see the operating instructions for the instrument involved.

CHECK 605 AND SYSTEM. Before proceeding with troubleshooting of the 605, check that the other instruments in the system are operating correctly. Check for proper interconnection between the display unit and the other instruments in the system.

VISUAL CHECK. Visually check the portion of the instrument in which the trouble is suspected. Many troubles can be located by visual indications such as unsoldered connections, broken wires, damaged circuit board, damaged components, etc.

CHECK INSTRUMENT ADJUSTMENT. Check the adjustment of the 605, or check the affected circuit if the trouble appears in one circuit. The apparent trouble may only be a result of misadjustment. Complete adjustment instructions are given later in this manual.

ISOLATE THE TROUBLE TO A CIRCUIT. To isolate trouble to a particular circuit, note the trouble symptom. The symptom often identifies the circuit in which the trouble is located. For example, poor focus indicates that the crt circuit (includes high-voltage supplies) is probably at fault. When trouble symptoms appear in more than one circuit, check affected circuits by taking voltage and waveform readings.

Incorrect operation of all circuits often indicates trouble in the power supply. Check first for correct voltage of the individual supplies. However, a defective component elsewhere in the instrument can appear as a power-supply trouble and may also affect the operation of other circuits. Table 3-1 lists the tolerances of the power supplies in this instrument. These voltages are measured between the power-supply test points and ground on the Power Supply circuit board (see the adjustments LV Power Supply Circuit Board foldout page in this manual for test point locations). If a power-supply voltage is within the listed tolerance, the supply can be assumed to be working correctly. If outside the tolerance, the supply may be misadjusted or operating incorrectly. Use the procedure given in the adjustment procedure to adjust the power supplies.

TABLE 3-1

Power Supply Tolerances

Power Supply	Tolerance	Typical Peak-to-Peak Ripple
−30 V	−29.10 V to −30.90 V	5 mV or less
+5 V	+4.75 V to +5.25 V	5 mV or less
+15 V	+14.92 V to +15.08 V	5 mV or less
+80 V	+75 V to +90 V	0.5 V or less
+170 V	+160 V to +190 V	1 V or less
−1500 V	−1470 V to −1530 V	

CHECK VOLTAGES AND WAVEFORMS. Often the defective component can be located by checking for the correct voltage or waveform in the circuit.

CHECK INDIVIDUAL COMPONENTS. The following methods are provided for checking the individual components in the 605. Components that are soldered in place are best checked by disconnecting one end, isolating the measurement from the effects of surrounding circuitry.

CAUTION

Power switch must be turned off before removing or replacing components, including semiconductors.

Transistors and Integrated Circuits. A good check of transistor operation is actual performance under operating conditions. A transistor can most effectively be checked by substituting a new component for it (or one which has been checked previously). However, be sure that circuit conditions are not such that a replacement transistor might also be damaged. If substitute transistors are not available, use a dynamic tester. Static-type testers are not recommended, since they do not check operation under simulated operating conditions. A desoldering tool must be used to remove soldered-in transistors; see component replacement procedure for details.

Integrated circuits (IC's) can be checked with a voltmeter, test oscilloscope, or by direct substitution. A good understanding of the circuit description is essential to troubleshooting circuits using IC's. Operating waveforms, logic levels, and other operating information for the IC's are given in the Theory of Operation section. Use care when checking voltages and waveforms around the IC's so that adjacent leads are not shorted together. A convenient means of clipping a test probe to a 14- and 16-pin in-line IC is with an integrated-circuit test clip. This device also doubles as an extraction tool.

Diodes. A diode can be checked for an open or shorted condition by measuring the resistance between terminals. With an ohmmeter scale having an internal source of between 800 millivolts and 3 volts, the resistance should be essentially infinite in one direction and very low when the leads are reversed.

CAUTION

Do not use an ohmmeter that has a high internal current. High currents may damage the diode.

Resistors. Check the resistors with an ohmmeter. Resistor tolerance is given in the electrical parts list. Resistors normally do not need to be replaced unless the measured value varies widely from the specified value.

Capacitors. A leaky or shorted capacitor can be detected by checking resistance with an ohmmeter on the highest scale. Use an ohmmeter that does not exceed the voltage rating of the capacitor. The resistance reading should be high after initial charge of the capacitor. An open capacitor can best be detected with a capacitance meter, or by checking whether the capacitor passes ac signals.

REPAIR AND READJUST THE CIRCUIT. Special techniques required to replace the components in this unit are given under Component Replacement. Be sure to check the performance of any circuit that has been repaired or that has had any electrical components replaced. Adjustment of the affected circuit may be necessary.

REPLACEMENT PARTS

STANDARD PARTS. All electrical and mechanical part replacements for the 605 can be obtained through your local Tektronix Field Office or representative. However, many of the standard electronic components can be obtained locally in less time than is required to order them from Tektronix, Inc. Before purchasing or ordering replacement parts, check the parts lists for value, tolerance, rating, and description.

NOTE

When selecting replacement parts, it is important to remember that the physical size and shape of the component may affect its performance in the instrument. All replacement parts should be direct replacements unless it is known that a different component will not adversely affect the instrument performance.

SPECIAL PARTS. Some parts are manufactured or selected by Tektronix to satisfy particular requirements, or are manufactured for Tektronix to our specifications. These special parts are indicated in the parts list by an asterisk preceding the part number. Most of the mechanical parts used in this system have been manufactured by Tektronix. Order all special parts directly from your local Tektronix Field Office or representative.

ORDERING PARTS. When ordering replacement parts from Tektronix, Inc., refer to the page immediately preceding the electrical parts list. Include the following information:

1. Instrument Type
2. Instrument Serial Number
3. A description of the part (if electrical, include the circuit number)
4. Tektronix Part Number

COMPONENT REPLACEMENT

The exploded-view drawings associated with the mechanical parts list (foldout pages) may be helpful when disassembling or re-assembling individual components or sub-assemblies.

CIRCUIT BOARD REPLACEMENT. If a circuit board is damaged beyond repair, the entire assembly, including all soldered-on components can be replaced. Part numbers are given in the mechanical parts lists for completely wired boards.

To remove or replace a board, proceed as follows:

1. Disconnect all leads connected to the board (both soldered lead connections and solderless pin connections).

2. Remove all screws holding the board to the chassis or other mounting surface. Some boards may be held fast on one side by a slotted plastic bar or slotted plastic clips in addition to the screws (for example, the low-voltage power supply and deflection boards). For these, remove the screws then pull the circuit board from its slot to free the board. Also, remove any obstructions, such as the push-on clips for the power transistor on the power supply board, that would prevent the board from being lifted out of the instrument.

3. Lift the circuit board out of the unit. Do not force or bend the board.

4. To replace the board, reverse the order of removal. Use care when replacing pin connectors; if forced into place incorrectly positioned, the pin connectors may be damaged.

TRANSISTOR AND INTEGRATED CIRCUIT REPLACEMENT. Transistors and IC's should not be replaced unless they are actually defective. If removed from their sockets during routine maintenance, return them to their original sockets. Unnecessary replacement or switching of semiconductor devices may affect the instrument adjustment. When a transistor is replaced, check the operation of the part of the instrument that may be affected.

CAUTION

POWER switch must be turned off before removing or replacing semiconductors.

Replacement semiconductors should be of the original type or a direct replacement. Fig. 3-1 shows the lead configuration of the semiconductors used in this instrument system. When removing soldered-in transistors, use a desoldering tool to remove the solder from the holes in the circuit board.

An extracting tool should be used to remove the 14- and 16-pin integrated circuits to prevent damage to the pins. This tool is available from Tektronix, Inc.; order Tektronix Part No. 003-0619-00. If an extracting tool is not available, use care to avoid damaging the pins. Pull slowly and evenly on both ends of the IC. Try to avoid having one end of the IC disengage from the socket before the other end.

To replace one of the power transistors mounted on the chassis adjacent to the Power Supply circuit board, first unsolder the leads. Then, remove the push-on clip that clamps the transistor to the chassis. Remove the defective transistor. When replacing the transistor, use silicone grease on both sides of the insulator plate and on the metal tab, if the transistor has one, to increase heat transfer from the transistor to the chassis.

INTERCONNECTING PIN REPLACEMENT. To replace a pin which is mounted on a circuit board, first disconnect any pin connectors. Then, unsolder the damaged pin and pull it out of the board with a pair of pliers. Be careful not to damage the wiring on the board with too much heat. Ream out the hole in the circuit board with a 0.031-inch drill. Remove the ferrule from the new interconnecting pin and press the new pin into the hole in the circuit board. Position the pin in the same manner as the old pin. If the old pin was bent at an angle to mate with a connector, bend the new pin to match the associated pins.

NOTE

A pin replacement kit including necessary tools, instructions, and replacement pins is available from Tektronix, Inc.; order Tektronix Part No. 040-0542-00.

SWITCH REPLACEMENT. The following special maintenance information is provided for the cam switches and pushbutton switches used in this instrument system.

CAUTION

Repair of cam switches should be undertaken only by experienced repair personnel. Switch alignment and spring tension of the contacts must be carefully maintained for proper operation of the switch. For assistance in repair of the cam switches, contact your local Tektronix Field Office or representative.

1. CAM SWITCHES

A Cam Switch Repair Kit, Tektronix Part No. 040-0541-00 is available to repair the cam switch in the 605 sweep option.

The cam switch consists of a rotating drum with lobes, whose position is controlled by the front-panel knob, which actuates spring-leaf contacts.

The following instructions have been generalized.

a. Remove any shields, switch shafts, interfering wires, components, or circuit boards which prevent access to the circuit board with the base cam switch contact.

NOTE

Cam switch bearing blocks that attach to more than one circuit board should not be separated from both boards during disassembly, unless absolutely necessary, because proper bearing realignment will be difficult.

b. Completely remove from the instrument the circuit board having the defective cam switch contact.

c. To replace the defective cam switch contacts, follow the instructions given in the switch repair kit.

d. To reassemble the instrument, reverse the disassembly procedure.

2. PUSHBUTTON SWITCHES

The pushbutton switches are not repairable and should be replaced as a unit if defective. Use a desoldering tool to remove solder from the holes in the circuit board when unsoldering the switches.

CATHODE-RAY TUBE REPLACEMENT. The following procedure outlines the removal and replacement of the cathode-ray tube.

WARNING

Use care when handling a crt. Protective clothing and safety glasses should be worn. Avoid striking it on any object which might cause it to crack or implode. When storing a crt, place it in a protective carton or set it face down in a protected location on a smooth surface with a soft mat under the faceplate to protect it from scratches.

1. REMOVAL

a. Remove the bezel assembly, which is held in place with two screws. (The bezel assembly includes a snap-in implosion shield.)

b. Disconnect deflection leads from crt neck pins, and disconnect the storage-element cable connector from the Storage circuit board.

NOTE

The red and black wires entering the crt shield are connected to the trace-rotation coil inside the shield. They will not hamper crt removal and need not be unsoldered.

c. Remove the crt base cover on the rear panel of the instrument. Remove the crt base-pin socket.

d. Disconnect the crt anode plug from the jack located on the panel adjacent to the left side of the crt shield.

WARNING

Ground the crt anode plug to the chassis momentarily to dissipate any stored charge.

e. With one hand on the crt faceplate, push on the crt base being sure to feed the storage-element cable and the anode lead through the slot and hole in the bottom and rear of the main portion of the crt shield as the crt slides forward. Pull the crt out of the instrument from the front.

2. REPLACEMENT

a. Make sure the solf plastic crt faceplate supports are in place, then insert the crt into the shield while feeding the storage-element cable and the anode lead through the slot and hole in the bottom and rear of the crt shield.

b. With the crt fully inserted and the shield hardware loose, mount the bezel assembly into place and tighten the bezel screws.

NOTE

If the crt support ring has come out of the crt shield, place over rear of crt and position inside crt shield between crt and crt shield.

c. Position the rear of the crt (socket end) so that there is no tilt of the faceplate in relation to the bezel assembly, then tighten the positioning screws. Check that the four deflection crt neck pin receptacles are centered in the neck shield cutout, then tighten the clamp hardware.

d. Place the crt base socket onto the crt base pins. Replace the crt base cover on the rear panel. Connect the storage-element cable to the pin connectors on the Storage circuit board, and connect the deflection leads to the crt neck pins. Reconnect the crt anode plug to the jack from the high-voltage circuit board.

e. Replacing the crt will require partial instrument adjustment. Refer to the Adjustments information later in this manual.

POWER TRANSFORMER REPLACEMENT. Replace the power transformer only with a direct replacement Tektronix transformer. After the transformer has been replaced, check the power supply output voltages and the crt operation as outlined in the Adjustments information later in this manual.

FUSE REPLACEMENT. Table 3-2 gives the rating, location, and function of the fuses used in this instrument.

TABLE 3-2

Circuit Number	Rating	Function	Location
F10	2 A fast-blow	+20 V Unreg Supply for high-voltage oscillator	HV Power Supply Board
F120	120 VAC - 0.5 A slow-blow 220 VAC - 0.3 A slow-blow	Line-Voltage Input	Rear Panel

SPECIFICATIONS

The electrical specifications are valid only if (1) the instrument has been calibrated at an ambient temperature between +20° C and +30° C; (2) the instrument is operating at an ambient temperature between 0° C and +50° C, unless otherwise noted.

TABLE 3-3

Vertical and Horizontal Amplifiers

Characteristics	Performance Requirements	Supplemental Information
Deflection Factor Vertical	Nominally set for 1 V full scale.	Internally adjustable from ≤ 0.5 V to ≥ 2.5 V full scale. An internal 5:1 attenuator extends the deflection factor range to ≥ 12.5 V full scale.
Horizontal	Nominally set for 1 V full scale.	Internally adjustable from ≤ 0.5 V to ≥ 2.5 V full scale. An internal 5:1 attenuator extends the deflection factor range to ≥ 12.5 V full scale.
Polarity (Differential Inputs)	Positive signal applied to + input deflects beam up or to the right; negative signal deflects beam down or to the left. Positive signal applied to − input deflects beam down or to the left; negative signal deflects beam up or to the right.	
Response	Spot must reach new writing position within 1 μs from any on-screen position.	

TABLE 3-3 (cont)

Characteristics	Performance Requirements	Supplemental Information
Bandwidth	With 80% full-screen reference signal, amplifier bandwidth is 3 MHz; risetime 116 ns or less.	
Differential Capability 3 V Non-Attenuated Common Mode Dynamic Range	At least 100:1 CMRR to 100 kHz.	
15 V Common Mode Dynamic Range with 5X Attenuation	At least 50:1 CMRR to 100 kHz.	
Phase Difference	Within 1° between equal-gain X and Y amplifiers to 500 kHz.	
Position Stability	0.1 division or less per hour after 20 minute warm-up.	
Input Resistance and Capacitance	1 MΩ paralleled by less than 47 pF.	
Maximum Input Voltage	±100 V (dc + peak ac).	
Position Range		About ±12 major divisions from screen center to allow setting zero signal position anywhere on screen.

TABLE 3-4

Z Axis Amplifier

Characteristics	Performance Requirements	Supplemental Information
Useful Input Voltage	Adjustable from ≤ +1 V to ≥ +5 V for full intensity control when INTENSITY control is set to midrange. 0 V input cuts off visual intensity.	
Useful Frequency Range	DC to 5 MHz at −3 dB point. 70 ns risetime.	
Differential Capability 5 V Common Mode Dynamic Range	At least 100:1 CMRR to 100 kHz.	
Input Resistance and Capacitance	1 MΩ paralleled by less than 47 pF (differential inputs).	
Maximum Safe Input Voltage	±100 V (dc + peak ac) when INTENSITY control is fully ccw.	Crt beam positioned off screen.
Remote Inputs	≤ 0.52 V provides active low logic. Open, or ≥ 2.5 V is high logic level.	Gates are TTL compatible.
Erase Interval Output	Active low logic is ≤ 0.4 V. High logic level is ≥ 2.5 V.	Gate will drive 10 TTL loads.

TABLE 3-5

Cathode-Ray Tube Display

Characteristics	Performance Requirements	Supplemental Information
Geometry	Bowing or tilt ≤ 0.1 division	
Orthogonality	90° ±0.7°	
Halftone Luminance	≥ 100 fL.	CRT viewing area saturated.
Halftone Writing Speed	≥ 1 div/μs for 15 seconds viewtime at 40 μA beam current.	Front-panel OPERATE LEVEL control fully cw.
Halftone Resolution	≥ 10 lines/div.	
Erase Time	≈ 0.5 s.	
Phosphor	P31 standard.	
Deflection	Electrostatic.	
Acceleration Potential	8.5 kV.	
Graticule External Graticule	8 X 10 divisions with 0.9 cm/div.	
(See Option 1)		Orange graticule lines for Option 1 internal 8 X 10 division (0.9 cm/div) graticule.

TABLE 3-6

Environmental

Characteristics	Performance Requirements	Supplemental Information
Temperature Operating	0°C to +50°C.	
Storage	−40°C to +70°C.	
Altitude Operating	To 15,000 feet.	
Storage	To 50,000 feet.	
Vibration Operating and Nonoperating	With the instrument complete and operating, vibration frequency swept from 10 to 50 to 10 Hz at 1 minute per sweep. Vibrated 15 minutes in each of the three major axes at 0.025" total displacement. Held 3 minutes at any major resonance, or if none, at 50 Hz. Total time, 54 minutes.	

TABLE 3-6 (cont)

Characteristics	Performance Requirements	Supplemental Information
Shock Operating and Nonoperating	30 g's, 1/2 sine, 11 ms duration, 2 shocks in each direction along 3 major axes, for a total of 12 shocks.	
Transportation	Qualified under National Safe Transit Committee Test Procedure 1A, Category II.	

TABLE 3-7

Physical

Parameter	Information
Finish	Anodized aluminum panel with gray vinyl-coated frame. Blue vinyl-coated cabinet.
Overall Dimensions	See Fig. 3-3.
Total Depth of Rack for Rackmounting	19 inches.

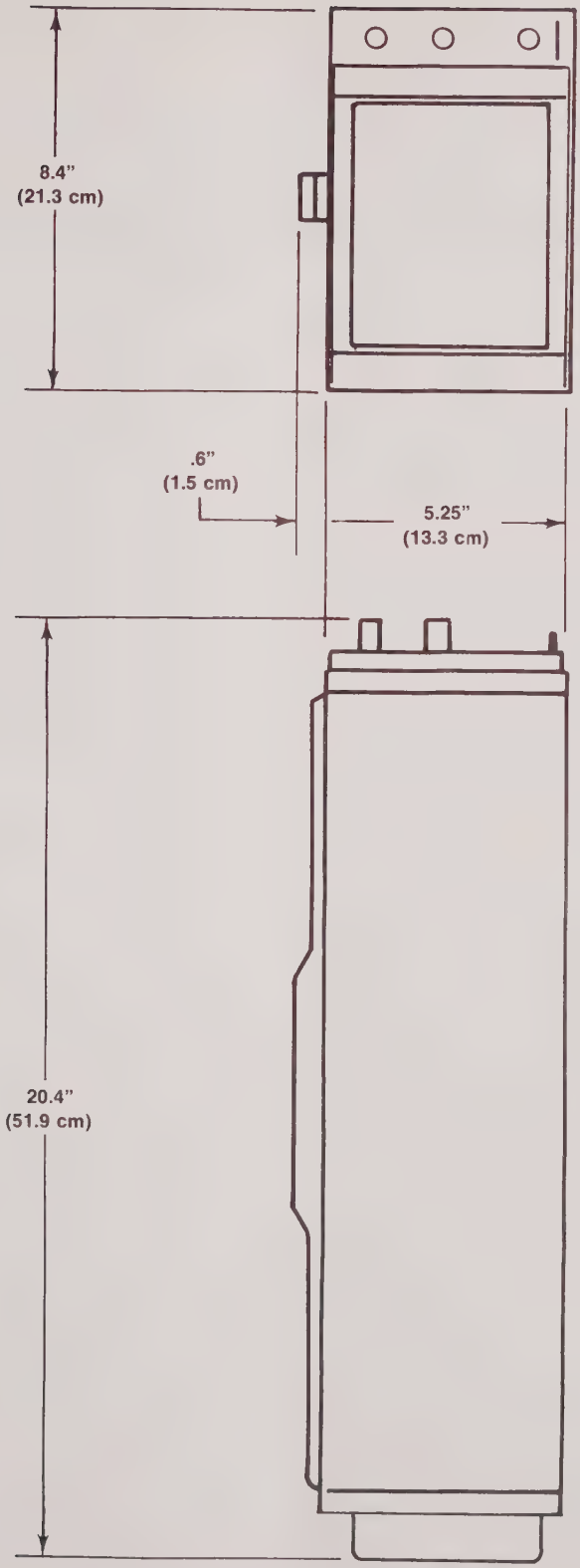


Fig. 3-3. Illustration showing dimensions of 605.

SYMBOLS AND REFERENCE DESIGNATORS

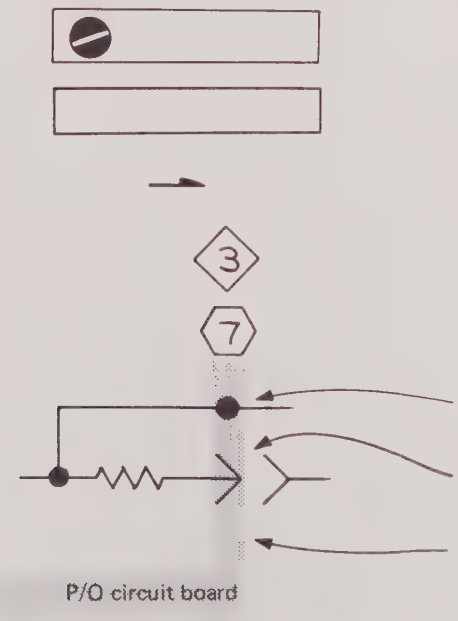
Electrical components shown on the diagrams are in the following units unless noted otherwise:

Capacitors =	Values one or greater are in picofarads (pF). Values less than one are in microfarads (μF).
Resistors =	Ohms (Ω)

Symbols used on the diagrams are based on ANSI Y32.2 – 1970.

Logic symbology is based on MIL-STD-806B in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

The following special symbols are used on the diagrams:



External Screwdriver adjustment.

External control or connector.

Clockwise control rotation in direction of arrow.

Refer to diagram number indicated in diamond.

Refer to waveform number indicated in hexagon.

Connection soldered to circuit board.

Connection made to circuit board with interconnecting pin.

Blue tint encloses components located on circuit board.

OPTIONS

Your instrument may be equipped with one or more options. This section describes those options, or directs the reader to where the option is documented.

Option 1 — Information relating to Option 1 (crt having internal graticule without graticule lights) is found in the Electrical Parts list near V100.

Option 2 — Not applicable.

Option 3 — Information on Option 3 (instrument without handle or feet) will be found on the Fig. 1 Exploded & Option No. 3 foldout.

Option 4 — Information for Option 4 (time base) will be found in the foldout pages.

REPLACEABLE ELECTRICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

ACTR	ACTUATOR	PLSTC	PLASTIC
ASSY	ASSEMBLY	QTZ	QUARTZ
CAP	CAPACITOR	RECP	RECEPTACLE
CER	CERAMIC	RES	RESISTOR
CKT	CIRCUIT	RF	RADIO FREQUENCY
COMP	COMPOSITION	SEL	SELECTED
CONN	CONNECTOR	SEMICOND	SEMICONDUCTOR
ELCTLT	ELECTROLYTIC	SENS	SENSITIVE
ELEC	ELECTRICAL	VAR	VARIABLE
INCAND	INCANDESCENT	WW	WIREWOUND
LED	LIGHT EMITTING DIODE	XFMR	TRANSFORMER
NONWIR	NON WIREWOUND	XTAL	CRYSTAL

CROSS INDEX MFR. CODE NUMBER TO MANUFACTURER

MFR.CODE	MANUFACTURER	ADDRESS	CITY,STATE,ZIP
00852	Sangamo Electric Co., S. Carolina Div.	P. O. Box 128	Pickens, SC 29671
01121	Allen-Bradley Co.	1201 2nd St. South	Milwaukee, WI 53204
01295	Texas Instruments, Inc., Semiconductor Group	P. O. Box 5012	Dallas, TX 75222
02735	RCA Corp., Solid State Division	Route 202	Somerville, NY 08876
03877	Transitron Electronic Corp.	168 Albion St.	Wakefield, MA 01880
03888	KDI Pyrofilm Corp.	60 S. Jefferson Rd.	Whippany, NJ 07981
04713	Motorola, Inc., Semiconductor Products Div.	5005 E. McDowell Rd.	Phoenix, AZ 85036
07263	Fairchild Semiconductor, A Div. of Fairchild Camera and Instrument Corp.	464 Ellis St.	Mountain View, CA 94042
07910	Teledyne Semiconductor	12515 Chadron Ave.	Hawthorne, CA 90250
08806	General Electric Co., Miniature Lamp Products Dept.	Nela Pk.	Cleveland, OH 44112
10389	Chicago Switch, Inc.	2035 Wabansia Ave.	Chicago, IL 60647
11237	CTS Keene, Inc.		Paso Robles, CA 93446
12040	National Semiconductor Corp.	Commerce Drive	Danbury, CT 06810
12969	Unitrode Corp.	580 Pleasant St.	Watertown, MA 02172
14936	General Instrument Corp., Semiconductor Products Group	600 W. John St.	Hicksville, NY 11802
22229	Solitron Devices, Inc., Diodes, Integrated Circuits and CMOS	8808 Balboa Ave.	San Diego, CA 92123
24931	Specialty Connector Co., Inc.	3560 Madison Ave.	Indianapolis, IN 46227
56289	Sprague Electric Co.		North Adams, MA 01247
71400	Bussman Mfg., Division of McGraw-Edison Co.	2536 W. University St.	St. Louis, MO 63107
71468	ITT Cannon Electric	666 E. Dyer Rd.	Santa Ana, CA 92702
71590	Centralab Electronics, Div. of Globe-Union, Inc.	5757 N. Green Bay Ave.	Milwaukee, WI 53201
72982	Erie Technological Products, Inc.	644 W. 12th St.	Erie, PA 16512
73138	Beckman Instruments, Inc., Helipot Div.	2500 Harbor Blvd.	Fullerton, CA 92634
75042	TRW Electronic Components, IRC Fixed Resistors, Philadelphia Division	401 N. Broad St.	Philadelphia, PA 19108
76493	Bell Industries, Inc., Miller, J. W., Div.	19070 Reyes Ave.	Compton, CA 90224
80009	Tektronix, Inc.	P. O. Box 500	Beaverton, OR 97077
80031	Electra-Midland Corp., Mepco Div., A North American Phillips Co.	22 Columbia Rd.	Morristown, NJ 07960
80740	Beckman Instruments, Inc.	2500 Harbor Blvd.	Fullerton, CA 92634
81483	International Rectifier Corp.	9220 Sunset Blvd.	Los Angeles, CA 90069
82383	Stevens Mfg. DELETED, Business discontinued		
83003	Varo, Inc.	800 W. Garland Ave.	Garland, TX 75040
90201	Mallory Capacitor Co., Div. of P. R. Mallory Co., Inc.	3029 E. Washington St.	Indianapolis, IN 46206
91637	Dale Electronics, Inc.	P. O. Box 609	Columbus, NB 68601
91929	Honeywell, Inc., Micro Switch Div.	Chicago & Spring Sts.	Freeport, IL 61032

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A1	670-3125-00			CKT BOARD ASSY:LOW VOLTAGE	80009	670-3125-00
A2	670-3081-00			CKT BOARD ASSY:HIGH VOLTAGE	80009	670-3081-00
A3	670-3178-00			CKT BOARD ASSY:DEFLECTION	80009	670-3178-00
A4	670-3182-00			CKT BOARD ASSY:Z AXIS	80009	670-3182-00
A5	670-3083-00			CKT BOARD ASSY:FRONT PANEL CONTROL/STORAGE	80009	670-3083-00
C18	290-0702-00			CAP.,FXD,ELCTLT:2000UF,+100-0%,50V	56289	68D10715
C20	290-0571-00			CAP.,FXD,ELCTLT:5000UF,+100-0%,25V	90201	20-36043
C21	290-0571-00			CAP.,FXD,ELCTLT:5000UF,+100-0%,25V	90201	20-36043
C36	290-0512-00	B010100	B010159	CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
C36	290-0559-00	B010160		CAP.,FXD,ELCTLT:22UF,20%,35V	56289	196D226X0035MA1
C40	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C46	281-0525-00			CAP.,FXD,CER DI:470PF,+/-94PF,500V	72982	301-000X5U0471M
C58	281-0543-00			CAP.,FXD,CER DI:270PF,10%,500V	72982	301-055X5P1271K
C60	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C62	290-0535-00			CAP.,FXD,ELCTLT:33UF,20%,10V	56289	196D336X0010KA1
C78	281-0524-00			CAP.,FXD,CER DI:150PF,+/-30PF,500V	72982	301-000X5U0151M
C88	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C90	290-0528-00			CAP.,FXD,ELCTLT:15UF,20%,50V	90201	TDC156M050WLC
C104	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C106	283-0021-00			CAP.,FXD,CER DI:0.001UF,20%,5000V	72982	828-005Y5S0102M
C112	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C114	283-0142-00			CAP.,FXD,CER DI:0.0027UF,5%,200V	72982	875-551B272J
C117	283-0081-00			CAP.,FXD,CER DI:0.1UF,+80-20%,25V	56289	36C600
C118	283-0010-00			CAP.,FXD,CER DI:0.05UF,+100-20%,50V	56289	273C20
C126	290-0536-00			CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025FL
C128	290-0536-00			CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025FL
C132	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C138	283-0300-00			CAP.,FXD,CER DI:0.001UF,+80-20%,10,000V	72982	3910BW509C142Z
C140	283-0300-00			CAP.,FXD,CER DI:0.001UF,+80-20%,10,000V	72982	3910BW509C142Z
C148	283-0105-00			CAP.,FXD,CER DI:0.01UF,+80-20%,2000V	56289	41C316
C149	283-0105-00			CAP.,FXD,CER DI:0.01UF,+80-20%,2000V	56289	41C316
C150	281-0512-00			CAP.,FXD,CER DI:27PF,+/-2.7PF,500V	72982	308-000C0G0270K
C154	283-0057-00			CAP.,FXD,CER DI:0.1UF,+80-20%,200V	56289	274C10
C156	283-0057-00			CAP.,FXD,CER DI:0.1UF,+80-20%,200V	56289	274C10
C158	290-0164-00			CAP.,FXD,ELCTLT:1UF,+50-10%,150V	56289	30D105F150BA2
C160	290-0164-00			CAP.,FXD,ELCTLT:1UF,+50-10%,150V	56289	30D105F150BA2
C180	283-0105-00			CAP.,FXD,CER DI:0.01UF,+80-20%,2000V	56289	41C316
C186	283-0021-00			CAP.,FXD,CER DI:0.001UF,20%,5000V	72982	828-005Y5S0102M
C188	290-0164-00			CAP.,FXD,ELCTLT:1UF,+50-10%,150V	56289	30D105F150BA2
C200	281-0203-00			CAP.,VAR,PLSTC:2-10PF,100V	80031	C010EA/10E
C202	281-0510-00			CAP.,FXD,CER DI:22PF,+/-4.4PF,500V	72982	301-000C0G0220M
C206	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C212	281-0544-00			CAP.,FXD,CER DI:5.6PF,10%,500V	72982	301-000C0H0569D
C218	281-0518-00			CAP.,FXD,CER DI:47PF,+/-9.4PF,500V	72982	301-000U2J0470M
C246	281-0203-00			CAP.,VAR,PLSTC:2-10PF,100V	80031	C010EA/10E
C250	281-0661-00			CAP.,FXD,CER DI:0.8PF,+/-0.1PF,500V	72982	301-000C0G0808B
C256	281-0628-00			CAP.,FXD,CER DI:15PF,5%,600V	72982	301-000C0G0150G
C300	281-0203-00			CAP.,VAR,PLSTC:2-10PF,100V	80031	C010EA/10E
C302	281-0510-00			CAP.,FXD,CER DI:22PF,+/-4.4PF,500V	72982	301-000C0G0220M
C306	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C312	281-0544-00			CAP.,FXD,CER DI:5.6PF,10%,500V	72982	301-000C0H0569D
C320	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C326	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C350	281-0661-00			CAP.,FXD,CER DI:0.8PF,+/-0.1PF,500V	72982	301-000C0G0808B
C380	290-0572-00			CAP.,FXD,ELCTLT:0.1UF,20%,50V	56289	196D104X0050HA1

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C382	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C384	290-0572-00			CAP.,FXD,ELCTLT:0.1UF,20%,50V	56289	196D104X0050HA1
C400	281-0203-00			CAP.,VAR,PLSTC:2-10PF,100V	80031	C010EA/10E
C402	281-0510-00			CAP.,FXD,CER DI:22PF,+/-4.4PF,500V	72982	301-000C0G0220M
C406	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C412	281-0544-00			CAP.,FXD,CER DI:5.6PF,10%,500V	72982	301-000C0H0569D
C418	281-0518-00			CAP.,FXD,CER DI:47PF,+/-9.4PF,500V	72982	301-000U2J0470M
C435	281-0526-00	XB010160		CAP.,FXD,CER DI:1.5PF,+/-0.5PF,500V	72982	301-000S2K0159D
C446	281-0203-00			CAP.,VAR,PLSTC:2-10PF,100V	80031	C010EA/10E
C450	281-0534-00			CAP.,FXD,CER DI:3.3PF,+/-0.25PF,500V	72982	301-000C0J0339C
C456	283-0663-00			CAP.,FXD,MICA D:16.8PF,+/-0.5PF,500V	00853	D155C1689D0
C470	281-0203-00			CAP.,VAR,PLSTC:2-10PF,100V	80031	C010EA/10E
C500	281-0203-00			CAP.,VAR,PLSTC:2-10PF,100V	80031	C010EA/10E
C502	281-0510-00			CAP.,FXD,CER DI:22PF,+/-4.4PF,500V	72982	301-000C0G0220M
C506	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C512	281-0544-00			CAP.,FXD,CER DI:5.6PF,10%,500V	72982	301-000C0H0569D
C520	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C526	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C550	281-0534-00			CAP.,FXD,CER DI:3.3PF,+/-0.25PF,500V	72982	301-000C0J0339C
C606	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C612	281-0508-00			CAP.,FXD,CER DI:12PF,+/-0.6PF,500V	72982	301-000C0G0120J
C614	281-0549-00			CAP.,FXD,CER DI:68PF,10%,500V	72982	301-000U2J0680K
C642	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C656	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C662	281-0508-00			CAP.,FXD,CER DI:12PF,+/-0.6PF,500V	72982	301-000C0G0120J
C670	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C690	281-0534-00			CAP.,FXD,CER DI:3.3PF,+/-0.25PF,500V	72982	301-000C0J0339C
C692	281-0526-00			CAP.,FXD,CER DI:1.5PF,+/-0.5PF,500V	72982	301-000S2K0159D
C716	281-0629-00			CAP.,FXD,CER DI:33PF,5%,600V	72982	308-000C0G0330G
C718	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C724	283-0057-00			CAP.,FXD,CER DI:0.1UF,+80-20%,200V	56289	274C10
C734	281-0064-00			CAP.,VAR,PLSTC:0.25-1.5PF,600V	72982	530-002
C740	283-0057-00			CAP.,FXD,CER DI:0.1UF,+80-20%,200V	56289	274C10
C810	290-0572-00			CAP.,FXD,ELCTLT:0.1UF,20%,50V	56289	196D104X0050HA1
C812	283-0081-00			CAP.,FXD,CER DI:0.1UF,+80-20%,25V	56289	36C600
C814	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C816	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C820	290-0536-00			CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025FL
C840	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C848	290-0529-00			CAP.,FXD,ELCTLT:47UF,20%,20V	56289	196D476X0020LA3
C886	285-0686-00			CAP.,FXD,PLSTC:0.068UF,10%,100V	56289	410P108
C890	290-0535-00			CAP.,FXD,ELCTLT:33UF,20%,10V	56289	196D336X0010KA1
C895	285-0686-00			CAP.,FXD,PLSTC:0.068UF,10%,100V	56289	410P108
C904	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C1062	281-0627-00			CAP.,FXD,CER DI:1PF,+/-0.25PF,500V	72982	301-000C0G0109C
CR15	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	02735	37304
CR16	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	02735	37304
CR17	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	02735	37304
CR18	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	02735	37304
CR20	152-0556-00			SEMICOND DEVICE:BRIDGE,50V,2.5A	04713	MDA960-1
CR25	152-0107-00			SEMICOND DEVICE:SILICON,375V,400MA	80009	152-0107-00
CR27	152-0107-00			SEMICOND DEVICE:SILICON,375V,400MA	80009	152-0107-00
CR29	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	02735	37304
CR30	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR32	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	02735	37304

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
CR36	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	02735	37304
CR40	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR41	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR48	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR74	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR80	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR82	152-0141-02	B010100	B010159X	SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR90	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	02735	37304
CR106	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	80009	152-0333-00
CR107	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	80009	152-0333-00
CR120	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR138	152-0409-00			SEMICOND DEVICE:SILICON,12,000V,5MA	83003	VG-12X
CR139	152-0409-00			SEMICOND DEVICE:SILICON,12,000V,5MA	83003	VG-12X
CR148	152-0242-00			SEMICOND DEVICE:SILICON,225V,200MA	12969	NDP341
CR150	152-0409-00			SEMICOND DEVICE:SILICON,12,000V,5MA	83003	VG-12X
CR154	152-0586-00			SEMICOND DEVICE:SILICON,600V,500MA	14936	RMP5060
CR158	152-0586-00			SEMICOND DEVICE:SILICON,600V,500MA	14936	RMP5060
CR180	152-0242-00			SEMICOND DEVICE:SILICON,225V,200MA	12969	NDP341
CR182	152-0242-00			SEMICOND DEVICE:SILICON,225V,200MA	12969	NDP341
CR186	152-0242-00			SEMICOND DEVICE:SILICON,225V,200MA	12969	NDP341
CR208	152-0246-00			SEMICOND DEVICE:SILICON,400PIV,200MA	07910	CD12676
CR254	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR255	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR256	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR257	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR270	152-0061-00			SEMICOND DEVICE:SILICON,175V,100MA	80009	152-0061-00
CR272	152-0061-00			SEMICOND DEVICE:SILICON,175V,100MA	80009	152-0061-00
CR308	152-0246-00			SEMICOND DEVICE:SILICON,400PIV,200MA	07910	CD12676
CR408	152-0246-00			SEMICOND DEVICE:SILICON,400PIV,200MA	07910	CD12676
CR420	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR454	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR455	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR456	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR457	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR508	152-0246-00			SEMICOND DEVICE:SILICON,400PIV,200MA	07910	CD12676
CR520	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR608	152-0246-00			SEMICOND DEVICE:SILICON,400PIV,200MA	07910	CD12676
CR620	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR642	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR658	152-0246-00			SEMICOND DEVICE:SILICON,400PIV,200MA	07910	CD12676
CR670	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR698	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR699	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR730	152-0574-00			SEMICOND DEVICE:SILICON,120V	80009	152-0574-00
CR801	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR802	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR812	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR814	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR852	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR853	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR856	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR857	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR860	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR861	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR874	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
CR888	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR890	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR902	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR910	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR912	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR950	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR952	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR954	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR956	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR960	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR962	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR972	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR973	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR975	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR982	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR984	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR986	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR996	152-0107-00			SEMICOND DEVICE:SILICON,375V,400MA	80009	152-0107-00
CR998	152-0107-00			SEMICOND DEVICE:SILICON,375V,400MA	80009	152-0107-00
CR1000	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1016	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1018	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
F10	159-0029-00			FUSE,CARTRIDGE:0.3A,3AG,MED-BLOW	71400	MDL3-10
F10[1]	159-0032-00			FUSE,CARTRIDGE:3AG,0.5A,250V,SLOW-BLOW	71400	MDL1-2
F120	159-0021-00			FUSE,CARTRIDGE:3AG,2A,250V,FAST-BLOW	71400	AGC2
J20	131-0569-00			CONNECTOR,RCPT,:25 PIN,FEMALE	71468	DB25S
J200	131-0955-00			CONNECTOR,RCPT,:BNC,FEMALE	24931	28JR200-1
J300	131-0955-00			CONNECTOR,RCPT,:BNC,FEMALE	24931	28JR200-1
J400	131-0955-00			CONNECTOR,RCPT,:BNC,FEMALE	24931	28JR200-1
J500	131-0955-00			CONNECTOR,RCPT,:BNC,FEMALE	24931	28JR200-1
J600	131-0955-00			CONNECTOR,RCPT,:BNC,FEMALE	24931	28JR200-1
J650	131-0955-00			CONNECTOR,RCPT,:BNC,FEMALE	24931	28JR200-1
L145	108-0792-00			COIL,TUBE DEFLE:TRACE ROTATION	80009	108-0792-00
L154	108-0324-00			COIL,RF:130UH	76493	70F102A1
L158	108-0324-00			COIL,RF:130UH	76493	70F102A1
L172	108-0714-00	XB010190		COIL,TUBE DEFLE:Y AXIS ALIGNMENT	80009	108-0714-00
P10	161-0033-12			CABLE ASSY,PWR:	80009	161-0033-12
P20	131-0570-00			CONNECTOR,RCPT,:25 PIN,MALE	71468	DB25P
Q30	151-0405-00			TRANSISTOR:SILICON,NPN,SEL FROM MJE800	04713	SJE943
Q32	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249
Q50	151-0341-00			TRANSISTOR:SILICON,NPN	07263	2N3565
Q60	151-0405-00			TRANSISTOR:SILICON,NPN,SEL FROM MJE800	04713	SJE943
Q64	151-0341-00			TRANSISTOR:SILICON,NPN	07263	2N3565
Q70	151-0405-00			TRANSISTOR:SILICON,NPN,SEL FROM MJE800	04713	SJE943
Q76	151-0341-00			TRANSISTOR:SILICON,NPN	07263	2N3565
Q80	151-0341-00			TRANSISTOR:SILICON,NPN	07263	2N3565
Q120	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q130	151-0349-00			TRANSISTOR:SILICON,NPN SEL FROM MJE2801	04713	SJE924
Q132	151-0103-00			TRANSISTOR:SILICON,NPN	04713	2N2219A
Q210A,B	151-1054-00			TRANSISTOR:SILICON,JFE,N-CHANNEL,DUAL	22229	FD1644
Q220	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249
Q230	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249
Q232	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249

[1]For 240V line only.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q260	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249
Q264	151-0279-00			TRANSISTOR:SILICON,NPN	07263	S25381
Q320	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249
Q330	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249
Q332	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249
Q360	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249
Q364	151-0279-00			TRANSISTOR:SILICON,NPN	07263	S25381
Q410A,B	151-1054-00			TRANSISTOR:SILICON,JFE,N-CHANNEL,DUAL	22229	FD1644
Q420	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249
Q430	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249
Q432	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249
Q460	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249
Q464	151-0190-00			TRANSISTOR:SILICON,NPN	04713	2N3904
Q520	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249
Q530	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249
Q532	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249
Q560	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249
Q564	151-0190-00			TRANSISTOR:SILICON,NPN	04713	2N3904
Q610A,B	151-1054-00			TRANSISTOR:SILICON,JFE,N-CHANNEL,DUAL	22229	FD1644
Q620	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249
Q630	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249
Q640	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249
Q670	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249
Q680	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249
Q690	151-0341-00			TRANSISTOR:SILICON,NPN	07263	2N3565
Q700	151-0341-00			TRANSISTOR:SILICON,NPN	07263	2N3565
Q710	151-0341-00			TRANSISTOR:SILICON,NPN	07263	2N3565
Q720	151-0279-00			TRANSISTOR:SILICON,NPN	07263	S25381
Q724	151-0270-00			TRANSISTOR:SILICON,PNP,SEL FROM 2N3495	03877	ST30032
Q810	151-0341-00			TRANSISTOR:SILICON,NPN	07263	2N3565
Q835	151-0126-00			TRANSISTOR:SILICON,NPN	07263	2N2484
Q872	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q876	151-0190-00			TRANSISTOR:SILICON,NPN	04713	2N3904
Q990	151-0190-00			TRANSISTOR:SILICON,NPN	04713	2N3904
Q996	151-0292-00			TRANSISTOR:SILICON,NPN	01295	TIS100
Q1010	151-0292-00			TRANSISTOR:SILICON,NPN	01295	TIS100
Q1026	151-0341-00			TRANSISTOR:SILICON,NPN	07263	2N3565
Q1036	151-0292-00			TRANSISTOR:SILICON,NPN	01295	TIS100
Q1050	151-0292-00			TRANSISTOR:SILICON,NPN	01295	TIS100
Q1060	151-0216-00			TRANSISTOR:SILICON,PNP	04713	MPS6523
Q1066	151-0292-00			TRANSISTOR:SILICON,NPN	01295	TIS100
R25	315-0221-00			RES.,FXD,COMP:220 OHM,5%,0.25W	01121	CB2215
R27	315-0221-00			RES.,FXD,COMP:220 OHM,5%,0.25W	01121	CB2215
R30	315-0333-00			RES.,FXD,COMP:33K OHM,5%,0.25W	01121	CB3335
R31	315-0472-00			RES.,FXD,COMP:4.7K OHM,5%,0.25W	01121	CB4725
R34	308-0568-00			RES.,FXD,WW:35 OHM,5%,5W	91637	RS5-K35R00J
R36	308-0702-00			RES.,FXD,WW:0.33 OHM,5%,2W	75042	BWH-R3300J
R38	321-0250-00			RES.,FXD,FILM:3.92K OHM,1%,0.125W	75042	CEAT0-3921F
R40	311-1565-00			RES.,VAR,NONWIR:250 OHM,20%,0.50W	73138	91A250R0M
R42	321-0242-00			RES.,FXD,FILM:3.24K OHM,1%,0.125W	75042	CEAT0-3241F
R44	315-0334-00			RES.,FXD,COMP:330K OHM,5%,0.25W	01121	CB3345
R46	315-0561-00			RES.,FXD,COMP:560 OHM,5%,0.25W	01121	CB5615
R48	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R50	315-0202-00			RES.,FXD,COMP:2K OHM,5%,0.25W	01121	CB2025

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R54	315-0822-00			RES.,FXD,COMP:8.2K OHM,5%,0.25W	01121	CB8225
R56	305-0620-00			RES.,FXD,COMP:62 OHM,5%,2W	01121	HB6205
R58	315-0152-00			RES.,FXD,COMP:1.5K OHM,5%,0.25W	01121	CB1525
R60	321-0254-00			RES.,FXD,FILM:4.32K OHM,1%,0.125W	75042	CEAT0-4321F
R62	321-0335-00			RES.,FXD,FILM:30.1K OHM,1%,0.125W	75042	CEAT0-3012F
R64	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R70	308-0218-00			RES.,FXD,WW:150 OHM,5%,3W	91637	RS2B-150R0J
R72	308-0764-00			RES.,FXD,WW:2.7 OHM,5%,2W	75042	BWF2R70F
R74	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R76	315-0823-00			RES.,FXD,COMP:82K OHM,5%,0.25W	01121	CB8235
R78	315-0331-00			RES.,FXD,COMP:330 OHM,5%,0.25W	01121	CB3315
R80	315-0334-00			RES.,FXD,COMP:330K OHM,5%,0.25W	01121	CB3345
R82	315-0183-00			RES.,FXD,COMP:18K OHM,5%,0.25W	01121	CB1835
R84	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R86	321-0306-00			RES.,FXD,FILM:15K OHM,1%,0.125W	75042	CEAT0-1502F
R88	321-0335-00			RES.,FXD,FILM:30.1K OHM,1%,0.125W	75042	CEAT0-3012F
R100	311-1555-00			RES.,VAR,NONWIR:100K OHM,20%,0.5W	73138	91A-10002M
R102	321-0473-00			RES.,FXD,FILM:825K OHM,1%,0.125W	75042	CEAT0-8253F
R104A,B	307-0290-06			RES.,FXD,FILM:HIGH VOLTAGE DIV	80009	307-0290-06
R104C,D	307-0290-06			RES.,FXD,FILM:HIGH VOLTAGE DIV	80009	307-0290-06
R106	315-0123-00			RES.,FXD,COMP:12K OHM,5%,0.25W	01121	CB1235
R108	321-0360-00			RES.,FXD,FILM:54.9K OHM,1%,0.125W	75042	CEAT0-5492F
R110	321-0258-00			RES.,FXD,FILM:4.75K OHM,1%,0.125W	75042	CEAT0-4751F
R112	315-0821-00			RES.,FXD,COMP:820 OHM,5%,0.25W	01121	CB8215
R114	315-0104-00			RES.,FXD,COMP:100K OHM,5%,0.25W	01121	CB1045
R116	315-0563-00			RES.,FXD,COMP:56K OHM,5%,0.25W	01121	CB5635
R118	315-0331-00			RES.,FXD,COMP:330 OHM,5%,0.25W	01121	CB3315
R120	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R124	315-0273-00			RES.,FXD,COMP:27K OHM,5%,0.25W	01121	CB2735
R126	315-0152-00			RES.,FXD,COMP:1.5K OHM,5%,0.25W	01121	CB1525
R128	308-0459-00			RES.,FXD,WW:1.1 OHM,5%,3W	91637	RS2B-D1R100J
R130	315-0271-00			RES.,FXD,COMP:270 OHM,5%,0.25W	01121	CB2715
R132	315-0391-00			RES.,FXD,COMP:390 OHM,5%,0.25W	01121	CB3915
R140	301-0335-00			RES.,FXD,COMP:3.3M OHM,5%,0.50W	01121	EB3355
R141	301-0335-00			RES.,FXD,COMP:3.3M OHM,5%,0.50W	01121	EB3355
R145	311-1332-00			RES.,VAR,NONWIR:5K OHM,10%,2W	01121	10M480
R148	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R150	315-0564-00			RES.,FXD,COMP:560K OHM,5%,0.25W	01121	CB5645
R158	315-0180-00			RES.,FXD,COMP:18 OHM,5%,0.25W	01121	CB1805
R162	315-0133-00			RES.,FXD,COMP:13K OHM,5%,0.25W	01121	CB1335
R165	311-1555-00			RES.,VAR,NONWIR:100K OHM,20%,0.5W	73138	91A-10002M
R170	311-1555-00			RES.,VAR,NONWIR:100K OHM,20%,0.5W	73138	91A-10002M
R172	315-0122-00	XB010190		RES.,FXD,COMP:1.2K OHM,5%,0.25W	01121	CB1225
R173	311-1561-00	XB010190		RES.,VAR,NONWIR:2.5K OHM,20%,0.50W	73138	91A-25000M
R174	315-0122-00	XB010190		RES.,FXD,COMP:1.2K OHM,5%,0.25W	01121	CB1225
R175A,B	311-1687-00			RES.,VAR,NONWIR:2K OHM X 5M OHM,20%,0.5W	01121	12M359
R180	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R182	315-0106-00			RES.,FXD,COMP:10M OHM,5%,0.25W	01121	CB1065
R184	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R186	315-0471-00			RES.,FXD,COMP:470 OHM,5%,0.25W	01121	CB4715
R188	315-0221-00			RES.,FXD,COMP:220 OHM,5%,0.25W	01121	CB2215
R190	321-0373-00			RES.,FXD,FILM:75K OHM, 1%,0.125W	75042	CEAT0-7502F
R192	311-1555-00			RES.,VAR,NONWIR:100K OHM,20%,0.5W	73138	91A-10002M
R194	321-0373-00			RES.,FXD,FILM:75K OHM, 1%,0.125W	75042	CEAT0-7502F
R200	321-0891-00			RES.,FXD,FILM:800K OHM,1%,0.125W	75042	CEAT0-8003F

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R202	321-0423-00			RES.,FXD,FILM:249K OHM,1%,0.125W	75042	CEAT0-2493F
R204	322-0481-00			RES.,FXD,FILM:1M OHM,1%,0.25W	75042	CEBT0-1004F
R206	321-0385-00			RES.,FXD,FILM:100K OHM,1%,0.125W	75042	CEAT0-1003F
R208	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R210	315-0822-00			RES.,FXD,COMP:8.2K OHM,5%,0.25W	01121	CB8225
R212	321-0207-00			RES.,FXD,FILM:1.4K OHM,1%,0.125W	75042	CEAT0-1401F
R215	311-1561-00			RES.,VAR,NONWIR:2.5K OHM,20%,0.50W	73138	91A-25000M
R216	315-0470-00			RES.,FXD,COMP:47 OHM,5%,0.25W	01121	CB4705
R218	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R220	315-0751-00			RES.,FXD,COMP:750 OHM,5%,0.25W	01121	CB7515
R222	315-0752-00			RES.,FXD,COMP:7.5K OHM,5%,0.25W	01121	CB7525
R226	315-0153-00			RES.,FXD,COMP:15K OHM,5%,0.25W	01121	CB1535
R228	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R230	315-0822-00			RES.,FXD,COMP:8.2K OHM,5%,0.25W	01121	CB8225
R232	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R234	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R238	315-0392-00			RES.,FXD,COMP:3.9K OHM,5%,0.25W	01121	CB3925
R240	311-1311-00			RES.,VAR,NONWIR:1K OHM,20%,1W	01121	10M155A
R242	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	75042	CEAT0-1002F
R246	315-0182-00			RES.,FXD,COMP:1.8K OHM,5%,0.25W	01121	CB1825
R250	321-0385-00			RES.,FXD,FILM:100K OHM,1%,0.125W	75042	CEAT0-1003F
R254	315-0752-00			RES.,FXD,COMP:7.5K OHM,5%,0.25W	01121	CB7525
R256	315-0821-00			RES.,FXD,COMP:820 OHM,5%,0.25W	01121	CB8215
R260	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R262	315-0471-00			RES.,FXD,COMP:470 OHM,5%,0.25W	01121	CB4715
R264	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R266	308-0349-00			RES.,FXD,WW:3.6K OHM,1%,3W	91637	RS2B-B36000F
R268	315-0240-00			RES.,FXD,COMP:24 OHM,5%,0.25W	01121	CB2405
R270	323-0154-00			RES.,FXD,FILM:392 OHM,1%,0.50W	75042	CECT0-3920F
R272	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R300	321-0891-00			RES.,FXD,FILM:800K OHM,1%,0.125W	75042	CEAT0-8003F
R302	321-0423-00			RES.,FXD,FILM:249K OHM,1%,0.125W	75042	CEAT0-2493F
R304	322-0481-00			RES.,FXD,FILM:1M OHM,1%,0.25W	75042	CEBT0-1004F
R306	321-0385-00			RES.,FXD,FILM:100K OHM,1%,0.125W	75042	CEAT0-1003F
R308	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R310	315-0822-00			RES.,FXD,COMP:8.2K OHM,5%,0.25W	01121	CB8225
R312	321-0207-00			RES.,FXD,FILM:1.4K OHM,1%,0.125W	75042	CEAT0-1401F
R322	315-0752-00			RES.,FXD,COMP:7.5K OHM,5%,0.25W	01121	CB7525
R326	315-0153-00			RES.,FXD,COMP:15K OHM,5%,0.25W	01121	CB1535
R328	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R330	315-0822-00			RES.,FXD,COMP:8.2K OHM,5%,0.25W	01121	CB8225
R332	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R334	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R350	321-0385-00			RES.,FXD,FILM:100K OHM,1%,0.125W	75042	CEAT0-1003F
R360	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R362	315-0471-00			RES.,FXD,COMP:470 OHM,5%,0.25W	01121	CB4715
R364	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R366	308-0349-00			RES.,FXD,WW:3.6K OHM,1%,3W	91637	RS2B-B36000F
R368	315-0240-00			RES.,FXD,COMP:24 OHM,5%,0.25W	01121	CB2405
R380	315-0183-00			RES.,FXD,COMP:18K OHM,5%,0.25W	01121	CB1835
R382	315-0392-00			RES.,FXD,COMP:3.9K OHM,5%,0.25W	01121	CB3925
R400	321-0891-00			RES.,FXD,FILM:800K OHM,1%,0.125W	75042	CEAT0-8003F
R402	321-0423-00			RES.,FXD,FILM:249K OHM,1%,0.125W	75042	CEAT0-2493F
R404	322-0481-00			RES.,FXD,FILM:1M OHM,1%,0.25W	75042	CEBT0-1004F
R406	321-0385-00			RES.,FXD,FILM:100K OHM,1%,0.125W	75042	CEAT0-1003F

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R408	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R410	315-0822-00			RES.,FXD,COMP:8.2K OHM,5%,0.25W	01121	CB8225
R412	321-0207-00			RES.,FXD,FILM:1.4K OHM,1%,0.125W	75042	CEAT0-1401F
R415	311-1561-00			RES.,VAR,NONWIR:2.5K OHM,20%,0.50W	73138	91A-25000M
R416	315-0470-00			RES.,FXD,COMP:47 OHM,5%,0.25W	01121	CB4705
R418	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R420	315-0751-00			RES.,FXD,COMP:750 OHM,5%,0.25W	01121	CB7515
R422	315-0752-00			RES.,FXD,COMP:7.5K OHM,5%,0.25W	01121	CB7525
R426	315-0153-00			RES.,FXD,COMP:15K OHM,5%,0.25W	01121	CB1535
R428	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R430	315-0153-00			RES.,FXD,COMP:15K OHM,5%,0.25W	01121	CB1535
R432	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R434	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R438	315-0392-00			RES.,FXD,COMP:3.9K OHM,5%,0.25W	01121	CB3925
R440	311-1311-00			RES.,VAR,NONWIR:1K OHM,20%,1W	01121	10M155A
R442	321-0311-00			RES.,FXD,FILM:16.9K OHM,1%,0.125W	75042	CEAT0-1692F
R446	315-0472-00			RES.,FXD,COMP:4.7K OHM,5%,0.25W	01121	CB4725
R450	321-0354-00			RES.,FXD,FILM:47.5K OHM,1%,0.125W	75042	CEAT0-4752F
R454	315-0472-00			RES.,FXD,COMP:4.7K OHM,5%,0.25W	01121	CB4725
R456	315-0391-00			RES.,FXD,COMP:390 OHM,5%,0.25W	01121	CB3915
R460	315-0912-00			RES.,FXD,COMP:9.1K OHM,5%,0.25W	01121	CB9125
R464	315-0271-00			RES.,FXD,COMP:270 OHM,5%,0.25W	01121	CB2715
R466	321-0247-00			RES.,FXD,FILM:3.65K OHM,1%,0.125W	75042	CEAT0-3651F
R468	315-0430-00			RES.,FXD,COMP:43 OHM,5%,0.25W	01121	CB4305
R470	321-0196-00			RES.,FXD,FILM:1.07K OHM,1%,0.125W	75042	CEAT0-1071F
R500	321-0891-00			RES.,FXD,FILM:800K OHM,1%,0.125W	75042	CEAT0-8003F
R502	321-0423-00			RES.,FXD,FILM:249K OHM,1%,0.125W	75042	CEAT0-2493F
R504	322-0481-00			RES.,FXD,FILM:1M OHM,1%,0.25W	75042	CEBT0-1004F
R506	321-0385-00			RES.,FXD,FILM:100K OHM,1%,0.125W	75042	CEAT0-1003F
R508	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R510	315-0822-00			RES.,FXD,COMP:8.2K OHM,5%,0.25W	01121	CB8225
R512	321-0207-00			RES.,FXD,FILM:1.4K OHM,1%,0.125W	75042	CEAT0-1401F
R522	315-0752-00			RES.,FXD,COMP:7.5K OHM,5%,0.25W	01121	CB7525
R526	315-0153-00			RES.,FXD,COMP:15K OHM,5%,0.25W	01121	CB1535
R528	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R530	315-0153-00			RES.,FXD,COMP:15K OHM,5%,0.25W	01121	CB1535
R532	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R534	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R550	321-0354-00			RES.,FXD,FILM:47.5K OHM,1%,0.125W	75042	CEAT0-4752F
R560	315-0912-00			RES.,FXD,COMP:9.1K OHM,5%,0.25W	01121	CB9125
R564	315-0271-00			RES.,FXD,COMP:270 OHM,5%,0.25W	01121	CB2715
R566	321-0247-00			RES.,FXD,FILM:3.65K OHM,1%,0.125W	75042	CEAT0-3651F
R568	315-0430-00			RES.,FXD,COMP:43 OHM,5%,0.25W	01121	CB4305
R604	322-0481-00			RES.,FXD,FILM:1M OHM,1%,0.25W	75042	CEBT0-1004F
R606	315-0104-00			RES.,FXD,COMP:100K OHM,5%,0.25W	01121	CB1045
R608	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R610	315-0682-00			RES.,FXD,COMP:6.8K OHM,5%,0.25W	01121	CB6825
R612	321-0210-00			RES.,FXD,FILM:1.5K OHM,1%,0.125W	75042	CEAT0-1501F
R614	321-0142-00			RES.,FXD,FILM:294 OHM,1%,0.125W	75042	CEAT0-2940F
R615	311-1561-00			RES.,VAR,NONWIR:2.5K OHM,20%,0.50W	73138	91A-25000M
R620	315-0751-00			RES.,FXD,COMP:750 OHM,5%,0.25W	01121	CB7515
R622	315-0183-00			RES.,FXD,COMP:18K OHM,5%,0.25W	01121	CB1835
R630	321-0198-00			RES.,FXD,FILM:1.13K OHM,1%,0.125W	75042	CEAT0-1131F
R632	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R636	321-0158-00			RES.,FXD,FILM:432 OHM,1%,0.125W	75042	CEAT0-4320F

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R640	321-0127-00			RES.,FXD,FILM:205 OHM,1%,0.125W	75042	CEAT0-2050F
R642	321-0208-00			RES.,FXD,FILM:1.43K OHM,1%,0.125W	75042	CEAT0-1431F
R644	321-0321-00			RES.,FXD,FILM:21.5K OHM,1%,0.125W	75042	CEAT0-2152F
R654	322-0481-00			RES.,FXD,FILM:1M OHM,1%,0.25W	75042	CEBT0-1004F
R656	315-0104-00			RES.,FXD,COMP:100K OHM,5%,0.25W	01121	CB1045
R658	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R660	315-0682-00			RES.,FXD,COMP:6.8K OHM,5%,0.25W	01121	CB6825
R662	321-0210-00			RES.,FXD,FILM:1.5K OHM,1%,0.125W	75042	CEAT0-1501F
R672	315-0183-00			RES.,FXD,COMP:18K OHM,5%,0.25W	01121	CB1835
R680	321-0198-00			RES.,FXD,FILM:1.13K OHM,1%,0.125W	75042	CEAT0-1131F
R682	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R690	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R692	321-0254-00			RES.,FXD,FILM:4.32K OHM,1%,0.125W	75042	CEAT0-4321F
R698	315-0392-00			RES.,FXD,COMP:3.9K OHM,5%,0.25W	01121	CB3925
R710	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R712	315-0472-00			RES.,FXD,COMP:4.7K OHM,5%,0.25W	01121	CB4725
R716	315-0181-00			RES.,FXD,COMP:180 OHM,5%,0.25W	01121	CB1815
R724	301-0561-00			RES.,FXD,COMP:560 OHM,5%,0.50W	01121	EB5615
R726	315-0562-00			RES.,FXD,COMP:5.6K OHM,5%,0.25W	01121	CB5625
R728	315-0303-00			RES.,FXD,COMP:30K OHM,5%,0.25W	01121	CB3035
R730	315-0100-00			RES.,FXD,COMP:10 OHM,5%,0.25W	01121	CB1005
R734	322-0613-00			RES.,FXD,FILM:20.4K OHM,1%,0.25W	75042	CEBT0-2052F
R735	321-0253-00			RES.,FXD,FILM:4.22K OHM,1%,0.125W	75042	CEAT0-4221F
R740	301-0821-00			RES.,FXD,COMP:820 OHM,5%,0.50W	01121	EB8215
R802	315-0181-00			RES.,FXD,COMP:180 OHM,5%,0.25W	01121	CB1815
R806	315-0133-00			RES.,FXD,COMP:13K OHM,5%,0.25W	01121	CB1335
R808	315-0393-00			RES.,FXD,COMP:39K OHM,5%,0.25W	01121	CB3935
R810	315-0154-00			RES.,FXD,COMP:150K OHM,5%,0.25W	01121	CB1545
R812	315-0473-00			RES.,FXD,COMP:47K OHM,5%,0.25W	01121	CB4735
R814	315-0333-00			RES.,FXD,COMP:33K OHM,5%,0.25W	01121	CB3335
R816	315-0393-00			RES.,FXD,COMP:39K OHM,5%,0.25W	01121	CB3935
R820	315-0752-00			RES.,FXD,COMP:7.5K OHM,5%,0.25W	01121	CB7525
R822	315-0152-00			RES.,FXD,COMP:1.5K OHM,5%,0.25W	01121	CB1525
R824	315-0753-00			RES.,FXD,COMP:75K OHM,5%,0.25W	01121	CB7535
R828	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R830	315-0123-00			RES.,FXD,COMP:12K OHM,5%,0.25W	01121	CB1235
R834	321-0458-00			RES.,FXD,FILM:576K OHM,1%,0.125W	91637	MFF1816G57602F
R835	311-1557-00			RES.,VAR,NONWIR:25K OHM,20%,0.50W	73138	91A-25001M
R838	315-0472-00			RES.,FXD,COMP:4.7K OHM,5%,0.25W	01121	CB4725
R840	315-0154-00			RES.,FXD,COMP:150K OHM,5%,0.25W	01121	CB1545
R844	315-0471-00			RES.,FXD,COMP:470 OHM,5%,0.25W	01121	CB4715
R846	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R848	315-0163-00			RES.,FXD,COMP:16K OHM,5%,0.25W	01121	CB1635
R852	315-0470-00			RES.,FXD,COMP:47 OHM,5%,0.25W	01121	CB4705
R853	315-0222-00			RES.,FXD,COMP:2.2K OHM,5%,0.25W	01121	CB2225
R856	315-0183-00			RES.,FXD,COMP:18K OHM,5%,0.25W	01121	CB1835
R860	315-0181-00			RES.,FXD,COMP:180 OHM,5%,0.25W	01121	CB1815
R862	315-0393-00			RES.,FXD,COMP:39K OHM,5%,0.25W	01121	CB3935
R864	315-0393-00			RES.,FXD,COMP:39K OHM,5%,0.25W	01121	CB3935
R866	315-0471-00			RES.,FXD,COMP:470 OHM,5%,0.25W	01121	CB4715
R870	315-0153-00			RES.,FXD,COMP:15K OHM,5%,0.25W	01121	CB1535
R872	315-0364-00			RES.,FXD,COMP:360K OHM,5%,0.25W	01121	CB3645
R874	315-0153-00			RES.,FXD,COMP:15K OHM,5%,0.25W	01121	CB1535
R875	315-0104-00			RES.,FXD,COMP:100K OHM,5%,0.25W	01121	CB1045
R878	315-0562-00			RES.,FXD,COMP:5.6K OHM,5%,0.25W	01121	CB5625

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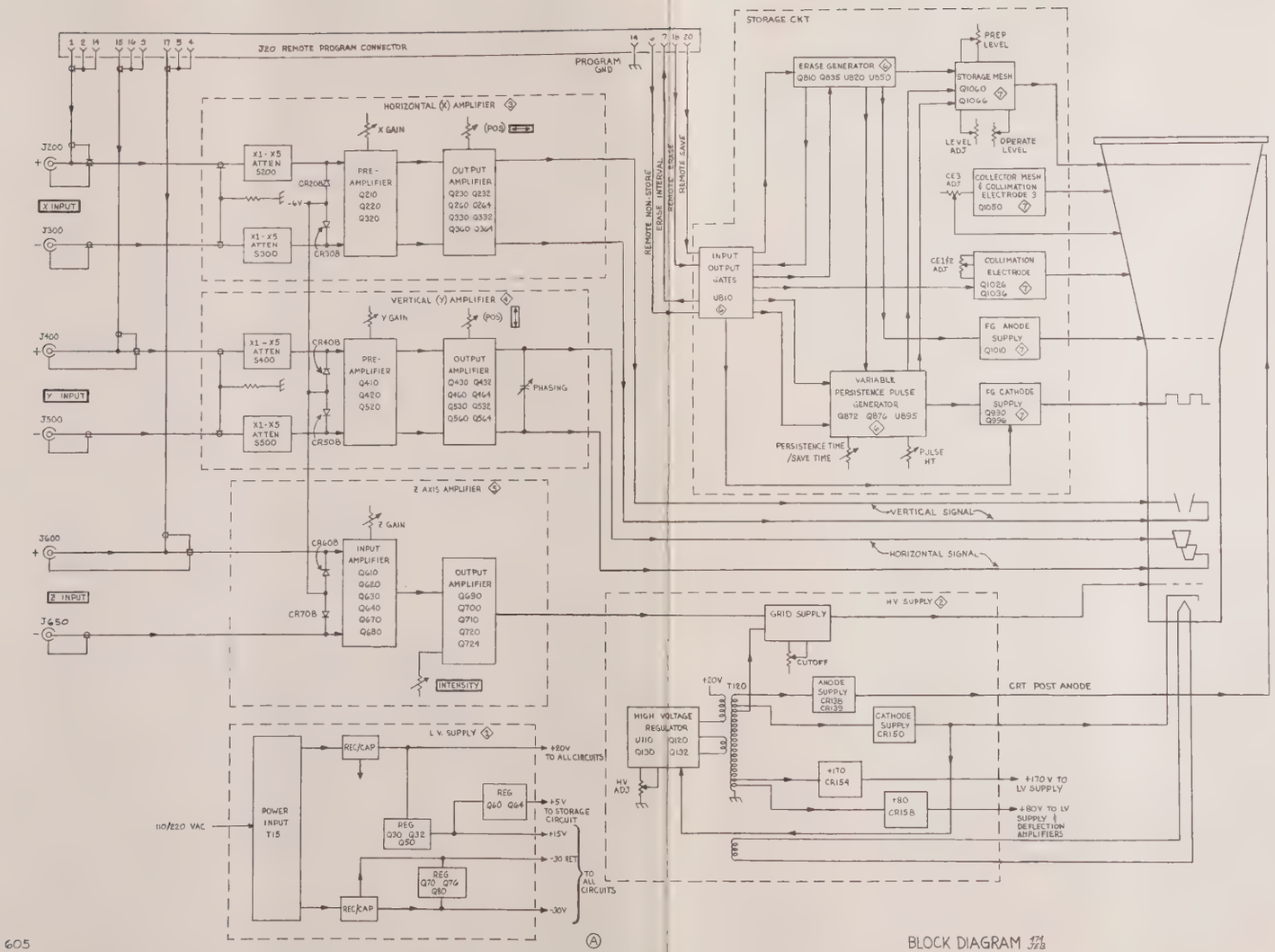
R880	315-0121-00			RES.,FXD,COMP:120 OHM,5%,0.25W	01121	CB1215
R882	315-0221-00			RES.,FXD,COMP:220 OHM,5%,0.25W	01121	CB2215
R886	315-0125-00			RES.,FXD,COMP:1.2M OHM,5%,0.25W	01121	CB1255
R888	315-0106-00			RES.,FXD,COMP:10M OHM,5%,0.25W	01121	CB1065
R890	315-0471-00			RES.,FXD,COMP:470 OHM,5%,0.25W	01121	CB4715
R892	315-0301-00			RES.,FXD,COMP:300 OHM,5%,0.25W	01121	CB3015
R894	315-0204-00			RES.,FXD,COMP:200K OHM,5%,0.25W	01121	CB2045
R895	311-1688-00			RES.,VAR,NONWIR:50K OHM,20%,1W	01121	12M360
R896	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R897	315-0821-00			RES.,FXD,COMP:820 OHM,5%,0.25W	01121	CB8215
R898	315-0473-00			RES.,FXD,COMP:47K OHM,5%,0.25W	01121	CB4735
R902	315-0272-00			RES.,FXD,COMP:2.7K OHM,5%,0.25W	01121	CB2725
R906	315-0393-00			RES.,FXD,COMP:39K OHM,5%,0.25W	01121	CB3935
R908	315-0393-00			RES.,FXD,COMP:39K OHM,5%,0.25W	01121	CB3935
R912	315-0181-00			RES.,FXD,COMP:180 OHM,5%,0.25W	01121	CB1815
R950	321-0393-00			RES.,FXD,FILM:121K OHM,1%,0.125W	75042	CEAT0-1213F
R960	315-0152-00			RES.,FXD,COMP:1.5K OHM,5%,0.25W	01121	CB1525
R962	315-0753-00			RES.,FXD,COMP:75K OHM,5%,0.25W	01121	CB7535
R965	311-1555-00			RES.,VAR,NONWIR:100K OHM,20%,0.5W	73138	91A-10002M
R966	321-0466-00			RES.,FXD,FILM:698K OHM,1%,0.125W	75042	CEAT0-6983F
R968	315-0106-00			RES.,FXD,COMP:10M OHM,5%,0.25W	01121	CB1065
R970	311-1710-00			RES.,VAR,NONWIR:20K OHM,20%,1W	01121	12M565
R972	315-0152-00			RES.,FXD,COMP:1.5K OHM,5%,0.25W	01121	CB1525
R973	315-0753-00			RES.,FXD,COMP:75K OHM,5%,0.25W	01121	CB7535
R975	311-1550-00			RES.,VAR,NONWIR:2M OHM,20%,0.50W	73138	91A-20003M
R976	315-0335-00			RES.,FXD,COMP:3.3M OHM,5%,0.25W	01121	CB3355
R982	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R984	315-0153-00			RES.,FXD,COMP:15K OHM,5%,0.25W	01121	CB1535
R986	315-0822-00			RES.,FXD,COMP:8.2K OHM,5%,0.25W	01121	CB8225
R990	315-0272-00			RES.,FXD,COMP:2.7K OHM,5%,0.25W	01121	CB2725
R992	315-0472-00			RES.,FXD,COMP:4.7K OHM,5%,0.25W	01121	CB4725
R994	308-0503-00			RES.,FXD,WW:6.8 OHM,5%,2.50W	91637	RS2B-D6R800J
R996	315-0272-00			RES.,FXD,COMP:2.7K OHM,5%,0.25W	01121	CB2725
R998	315-0104-00			RES.,FXD,COMP:100K OHM,5%,0.25W	01121	CB1045
R1000	315-0182-00			RES.,FXD,COMP:1.8K OHM,5%,0.25W	01121	CB1825
R1010	303-0303-00			RES.,FXD,COMP:30K OHM,5%,1W	01121	GB3035
R1012	315-0563-00			RES.,FXD,COMP:56K OHM,5%,0.25W	01121	CB5635
R1014	315-0513-00			RES.,FXD,COMP:51K OHM,5%,0.25W	01121	CB5135
R1016	315-0471-00			RES.,FXD,COMP:470 OHM,5%,0.25W	01121	CB4715
R1018	315-0123-00			RES.,FXD,COMP:12K OHM,5%,0.25W	01121	CB1235
R1026	315-0163-00			RES.,FXD,COMP:16K OHM,5%,0.25W	01121	CB1635
R1030	311-1556-00			RES.,VAR,NONWIR:50K OHM,20%,0.50W	73138	91A-50001M
R1032	315-0273-00			RES.,FXD,COMP:27K OHM,5%,0.25W	01121	CB2735
R1034	315-0223-00			RES.,FXD,COMP:22K OHM,5%,0.25W	01121	CB2235
R1036	305-0243-00			RES.,FXD,COMP:24K OHM,5%,2W	01121	HB2435
R1040	315-0513-00			RES.,FXD,COMP:51K OHM,5%,0.25W	01121	CB5135
R1045	311-1556-00			RES.,VAR,NONWIR:50K OHM,20%,0.50W	73138	91A-50001M
R1046	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R1050	303-0223-00	B010100	B010169	RES.,FXD,COMP:22K OHM,5%,1W	01121	GB2235
R1050	301-0223-00	B010170		RES.,FXD,COMP:22K OHM,5%,0.50W	01121	EB2235
R1052	321-0380-00			RES.,FXD,FILM:88.7K OHM,1%,0.125W	75042	CEAT0-8872F
R1054	321-0372-00			RES.,FXD,FILM:73.2K OHM,1%,0.125W	75042	CEAT0-7322F
R1060	321-0423-00			RES.,FXD,FILM:249K OHM,1%,0.125W	75042	CEAT0-2493F
R1062	321-0481-00			RES.,FXD,FILM:1M OHM,1%,0.125W	75042	CEAT0-1004F
R1064	315-0683-00			RES.,FXD,COMP:68K OHM,5%,0.25W	01121	CB6835

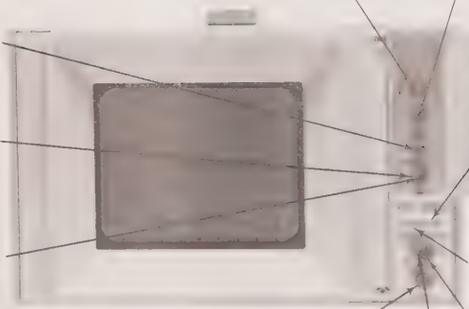
Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R1066	303-0563-00			RES.,FXD,COMP:56K OHM,5%,1W	01121	GB5635
R1068	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
S10	260-0413-00			SW,THERMOSTATIC:10A,240V	82383	110090
S12	260-1222-00			SWITCH,PUSH-PUL:10A,250VAC	91929	2DM301
S200	260-0723-00			SWITCH,SLIDE:DPDT,0.5A,125VAC	80009	260-0723-00
S220[1]	260-0723-00			SWITCH,SLIDE:DPDT,0.5A,125VAC	80009	260-0723-00
S300	260-0723-00			SWITCH,SLIDE:DPDT,0.5A,125VAC	80009	260-0723-00
S400	260-0723-00			SWITCH,SLIDE:DPDT,0.5A,125VAC	80009	260-0723-00
S500	260-0723-00			SWITCH,SLIDE:DPDT,0.5A,125VAC	80009	260-0723-00
S735[1]	260-0723-00			SWITCH,SLIDE:DPDT,0.5A,125VAC	80009	260-0723-00
S860[2]						
S870	260-1308-00			SWITCH,PUSH:MOMENTARY	71590	2KAA010000-440
S895[2]						
S910	260-1211-00			SWITCH,PUSH:DPDT,PUSH-PUSH	71590	2KAB010000-357
T15	120-0925-00			TRANSFORMER,PWR:	80009	120-0925-00
T120	120-0926-00			TRANSFORMER,HV:	80009	120-0926-00
U110	156-0067-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	80009	156-0067-00
U810	156-0057-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	07263	U6A740159X
U820	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL	12040	DM74121N
U850	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL	12040	DM74121N
U895	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL	12040	DM74121N
V100	154-0697-10			ELECRON TUBE:CRT	80009	154-0697-10
V100	154-0697-11			ELECTRON TUBE:	80009	154-0697-11
VR50	152-0166-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	81483	69-9035
VR130	152-0243-00			SEMICOND DEVICE:ZENER,0.4W,15V,5%	81483	1N965B
VR182	150-0111-00			LAMP,GLOW:NEON,1.2MA	08806	2AC-AT
VR183	150-0111-00			LAMP,GLOW:NEON,1.2MA	08806	2AC-AT
VR270	152-0149-00			SEMICOND DEVICE:ZENER,0.4W,10V,5%	04713	1N961B
VR670	152-0149-00			SEMICOND DEVICE:ZENER,0.4W,10V,5%	04713	1N961B
VR690	152-0227-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	81483	69-6585
VR915	152-0166-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	81483	69-9035

[1]Option 4 only.
[2]Furnished as a unit with R895.



BLOCK DIAGRAM 1/1

CONTROLS & CONNECTORS



Vertical Position Control

Moves crt writing beam or display up or down.

Horizontal Position Control

Moves crt writing beam or display left or right.

OPERATE LEVEL Control

Controls the writing speed and brightness of the stored displays.

INTENSITY Control

Controls display brightness in non-storage.

FOCUS Control

Provides adjustment to obtain a well-defined display.

STORE Pushbutton

A push-push button that selects storage operation of the CRT. Button out position selects normal operation without storage. In position of button selects storage operation. Storage operation can be remotely selected when the STORE pushbutton is out.

ERASE Pushbutton

Momentary pushbutton that initiates erasure of the displayed information stored on the crt screen.

POWER Switch

Turns instrument power on or off.

PERSISTENCE/SAVE TIME Control

Controls the display only when the instrument is operating in the storage mode.

PULL TO SAVE Switch

A push-pull switch that when pulled prevents accidental erasure or damage to the storage information. The pulled position also allows the stored information to be retained for long periods of time. The save mode can only be selected remotely when the PULL TO SAVE switch is pushed in.

If PULL TO SAVE switch is pushed in the control operates as a persistence control to determine the retention of the stored display (fully ccw is maximum retention).

With the PULL TO SAVE switch pulled out, the control extends the retention time longer than is available with the normal storage mode. The fully ccw control position (maximum retention) does not allow viewing the stored display.

THEORY OF OPERATION DIAGRAM 1

LOW-VOLTAGE POWER SUPPLIES

POWER INPUT

Power is applied to the primary of transformer T15 through fuse F10, thermal cutout S10, power switch S12, and line-selector block P15. The line-selector block allows changing the primary-winding taps of T15 to fit different line requirements.

LOW-VOLTAGE RECTIFIERS AND UNREGULATED OUTPUTS

The full-wave bridge rectifiers and associated filter components in the secondaries of T15 provide filtered dc voltages. The unregulated +20-volt output goes to the high-voltage transformer, where it is fuse protected.

LOW-VOLTAGE REGULATORS

+15-VOLT SUPPLY. The +15-volt supply, besides providing power to circuitry throughout the instrument, provides a reference-voltage source to establish operating levels for the feedback regulators in the −30-volt and the +5-volt supplies. The regulator for the +15-volt supply is a feedback amplifier system that operates between ground and the unregulated +20-volts. Current to the load is delivered by series-pass transistor Q30 and the supply voltage is established by the drop across R38, R40 and R42, which is compared to the voltage drop across VR50 and the emitter-base junction of Q50. The feedback path is through CR40, CR41 and Q32 to the base of Q30. Any variation in output voltage due to ripple, change of current through the load, etc., is immediately transmitted to the base of Q30 and nullified by a change in Q30 conduction, thus maintaining a steady output. The output of the supply is set to exactly +15-volts by adjustment of R40, +15 V adjust. This control sets the conduction of Q50, which controls the bias level of Q30 via emitter-follower Q32, CR27 and CR25 provide initial starting current to turn on Q840. Q30 +80 V and +170 V supplied by the high-voltage circuit plus shunt resistor R34 provides sufficient operating voltage to start the high-voltage circuit.

Q32 protects the supply in the event of a current overload. The overload will cause the voltage across R36 to become high enough to overcome the voltage drops across CR40, CR41 and the base-collector junction of Q32. At this time, Q32 will become saturated and short out Q30, thereby current limiting the supply.

−30-Volt Supply. The regulator for the −30-volt supply consists of series-pass transistor Q70 and error amplifier Q80. This is a feedback amplifier system similar to that just described for the +15-volt supply. Q76 protects the supply in the event the output is shorted by limiting the current demanded from the series-pass transistor under excessive load.

+5-Volt Supply. The regulator for the +5-volt supply consists of series-pass transistor Q60 and error amplifier Q64. Operation of this feedback amplifier system is similiar to that described for the +15-volt supply. Current limiting, in the event of an overload, is provided by R56.

ADJUSTMENTS

LOW-VOLTAGE POWER SUPPLIES

Adjustment is generally required after a repair has been made, or after long time intervals in which normal aging of components may affect instrument accuracy. To assure instrument accuracy, check the calibration after every 2000 hours of operation, or every six months if used infrequently.

Before complete calibration, thoroughly clean and inspect this instrument as outlined in the Service Information section of this manual. The Service Information section also contains information for general maintenance of this instrument, including preventive maintenance, component identification and replacement, etc.

SERVICES AVAILABLE

Tektronix, Inc. provides complete instrument repair and calibration at local Field Service Centers and at the Factory Service Center. Contact your local Tektronix Field Office or representative for further information.

WARNING

Dangerous potentials exist at several points throughout this instrument. When the instrument is operated with the covers removed, do not touch exposed connections or components. Disconnect power before cleaning the instrument or replacing parts.

ADJUST AND CHECK POWER SUPPLIES

Connect the precision dc voltmeter between the +15-volt test point and ground. Adjust R40 +15 V, Adj, for a voltmeter reading of exactly +15-volts.

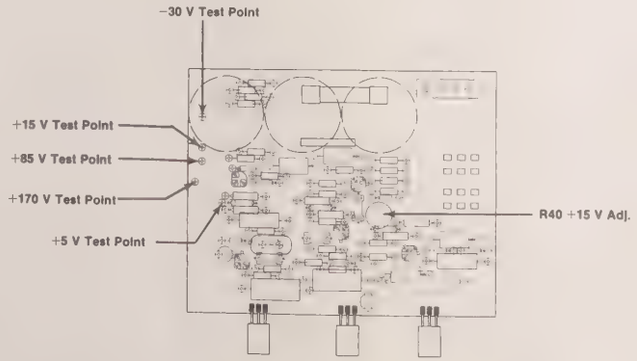
Connect the precision dc voltmeter between the remaining supply test points and ground, and check for the following accuracies:

−30 V	−29.10 V to −30.90 V
+5 V	+4.75 V to +5.25 V
+85 V	+75 V to +90 V
+120 V	+160 V to +190 V

Disconnect the precision dc voltmeter.

EQUIPMENT REQUIRED

1. DC voltmeter having an accuracy within ±0.1% and a measurement range of −30 volts to +180 volts. For example, a DM 501 Digital Multimeter (operates in a TM 500-Series Power Module), or any dc voltmeter meeting the requirements may be used.



PRELIMINARY PROCEDURE

NOTE

The performance of this instrument can be checked at any temperature within the 0° C to +50° C range Make any adjustment at a temperature of +25° C, ±5° C.

a. Check that the correct nominal line-selector block (120 VAC or 220 VAC) has been installed on the line selector pins and that the regulating range selected includes the input line voltage, see Installation section

b. Check that the crt screen (display area) has an 8 x 10-division scribed graticule; install one if necessary

c. Remove the outside cabinet panels to gain access to internal controls and test points

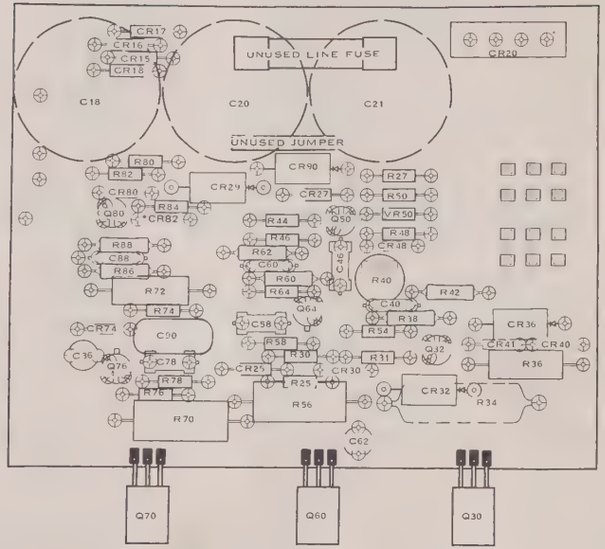
d. Connect the Monitor to the Line voltage source and apply power

e. Set the following controls

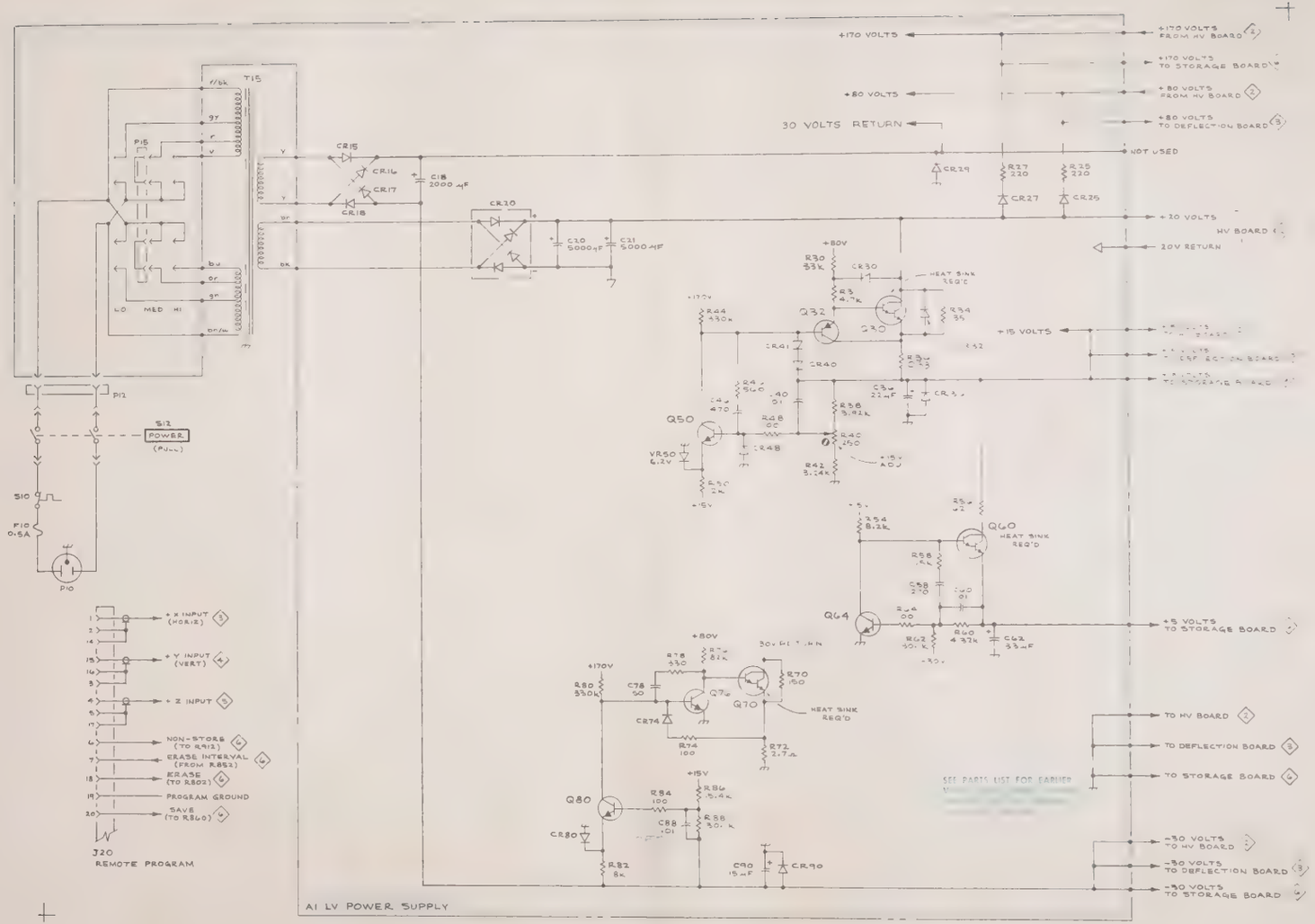
Internal attenuator slide switches (Deflection Amplifier board)	1:1 (up position)
XY-YT (Deflection Amplifier board and Z Axis board in Option 4 instruments only)	XY (down and to left position)
POWER	PULL ON (knob pulled out)
PULL TO SAVE	Knob pushed in
PERSISTENCE/SAVE TIME	Fully ccw
STORE	Non-store (button out)
INTENSITY	Fully ccw
FOCUS	Midrange
OPERATE LEVEL	As is
Vertical Position	Midrange
Horizontal Position	Midrange

PARTS LOCATION GRID

LOW VOLTAGE



CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C18	A1	CR15	B1	CR41	E4	Q60	D5	R36	F4	R62	C3	VR50	D2
C20	C1	CR16	B1	CR48	D3	Q64	D3	R38	D3	R64	C3		
C21	D1	CR17	B1	CR74	B4	Q70	B5	R40	D3	R70	B4		
C36	B4	CR18	B1	CR80	B2	Q76	B4	R42	E3	R72	B3		
C40	D3	CR20	E1	CR82	B3	Q80	B2	R44	C3	R74	B3		
C46	D3	CR25	C4	CR90	C2			R46	C3	R76	B4		
C58	C3	CR27	D2					R48	D3	R78	B4		
C60	C3	CR29	C2			R25	C4	R50	D2	R80	B2		
C62	D5	CR30	D4			R27	D2	R54	D4	R82	B2		
C78	B4	CR32	E4	Q30	E5	R30	C4	R56	C4	R84	B2		
C88	B3	CR38	F3	Q32	E4	R31	D4	R58	C4	R86	B3		
C90	B4	CR40	F4	Q50	D3	R34	E4	R60	C3	R88	B3		



THEORY OF OPERATION DIAGRAM 2

CRT CIRCUIT

HIGH-VOLTAGE REGULATOR

HIGH-VOLTAGE PRIMARY. A repetitive, sinusoidal signal is produced by a regenerative feedback oscillator in the primary of T120 and induced into the secondary. Current drive for the primary winding is furnished by Q130-Q132.

The conduction of Q130 and Q132 is controlled by the output voltage of U110.

HIGH-VOLTAGE REGULATION. Regulation is accomplished by applying a sample of the −1500 V, from the R104A-R104B divider, to the positive input (pin 3) of U110. The negative input (pin 2) of U400 is set by HV adj R400. If the output level of the cathode supply goes above the nominal −15 kV (goes more negative), the positive input (pin 3) of U110 goes negative from its quiescent +1.2 V. The output of U100 goes less positive, reducing the conduction of Q130-Q132. This reduces the peak-to-peak sinusoidal signal amplitude, resulting in a reduced voltage in the secondary of T120. Conversely, if the output drops below −1.5 kV (goes more positive), Q130-Q132 will conduct harder, i.e., have a larger sinusoidal signal amplitude. Q390 protects the high-voltage supply in the event the output is shorted by limiting the maximum current drawn by the high-voltage oscillator, Q130-Q132.

HIGH-VOLTAGE OUTPUTS

The secondary winding of T120 provides the negative and positive accelerating potentials for the crt, the bias voltage for the control grid, the +80 V and +170 V supply voltages used elsewhere in the 605 and the crt writing gun filament voltage.

Positive accelerating voltage for the crt anode is supplied by voltage doubler C138-CR138-CR139-C140. The applied voltage to the input of the doubler from the T120 secondary winding is about +7 kV peak-to-peak.

The output voltage of the doubler is about +14 kV at the crt anode. The negative accelerating voltage for the crt cathode is also obtained from the T120 secondary winding. CR150 half-wave rectifies the transformer output and supplies the 1.5 kV to the crt cathode. CRT writing gun filament voltage is provided by a winding on the secondary of T120 which is elevated to −1.5 kV.

Diodes CR182 and CR180 provide the rectified negative voltage for the crt control grid. The output level of this supply is set by the Cutoff adjustment R192. Diodes CR148 and CR186 clip the crt grid bias voltage from the T120 secondary, to determine the operating level at the control grid. CR148 limits the negative excursions of the bias voltage, depending upon the output voltage of the Z-Axis Amplifier. The positive clipping level at the cathode of CR186 is set by the Cutoff adjustment. CR182 acts as a dc restorer and CR4180 as a rectifier. This results in a dc level across R182 equal to the peak-to-peak excursion at the anode of CR186.

CRT CONTROL CIRCUITS

In addition to the INTENSITY control discussed previously, front-panel FOCUS and internal astigmatism controls have been incorporated for arriving at an optimum crt display. FOCUS control R175B provides the correct voltage for the second anode in the crt. Proper voltage for the third anode is obtained by adjusting Astig control R170. In order to obtain optimum spot size and shape, both the FOCUS and Astig controls are adjusted to provide the proper electrostatic lens configuration in the crt.

The Geom Adjustment R165 varies the positive level on the horizontal deflection plate shields to control the overall geometry of the display. The trace rotation control, R145, permits adjustment of the dc current through beam-rotation coil L145 to align the display horizontally.

ADJUSTMENTS

CRT CIRCUIT

WARNING

Dangerous potentials exist at several points throughout this instrument. When the instrument is operated with the covers removed, do not touch exposed connections or components. Disconnect power before cleaning the instrument or replacing parts.

EQUIPMENT REQUIRED

1. DC voltmeter, to measure HV supply. Minimum sensitivity rating, 20 kΩ/volt; range of at least 1500 volts full scale, accuracy within 1 1/2%. For example, Triplett 630 NA.

2. Ramp generator having a sawtooth amplitude between +1 volt and +3 volts, a +1 volt to +5 volt gate signal that is coincident with the sawtooth, and sweep rates from 10 μs to 0.5 ms. For example, a RG 501 Ramp Generator (operates in a TM 500-Series Power Module), or any ramp generator meeting the requirements may be used.

3. Coaxial cables (2). Impedance, 50 Ω; length, 42 inches; connectors, BNC. Tektronix Part No. 012-0057-01.

PRELIMINARY PROCEDURE

NOTE

The performance of this instrument can be checked at any temperature within the 0° C to +50° C range. Make any adjustment at a temperature of +25° c, ±5° C.

a. Check that the correct nominal line-selector (120 VAC or 220 VAC) has been installed on the line selector pins and that the regulating range selected includes the input line voltage, see Installation section.

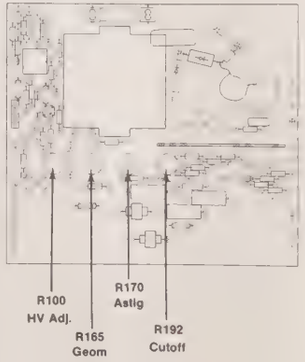
b. Check that the crt screen (display area) has an 8 x 10-divison scribed graticule; install one if necessary.

c. Remove the outside cabinet panels to gain access to internal controls and test points.

d. Connect the Monitor to the line voltage source and apply power.

e. Set the following controls:

Internal attenuator slide switches (Deflection Amplifier board)	1:1 (up position)
XY-TY (Deflection Amplifier board and Z Axis board in Option 4 instrument only)	XY (down and to left position)
POWER	PULL ON (knob pulled out)
PULL TO SAVE	Knob pushed in
PERSISTENCE/SAVE TIME	Fully ccw
STORE	Non-store (button out)
INTENSITY	Fully ccw
FOCUS	Midrange
OPERATE LEVEL	As is
Vertical Position	Midrange
Horizontal Position	Midrange



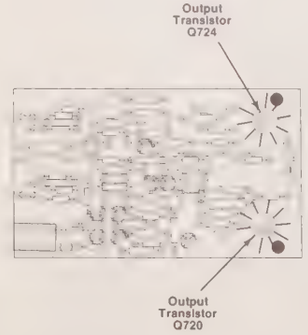
1. ADJUST AND CHECK HIGH-VOLTAGE POWER SUPPLY

CAUTION

Turn off instrument power when connecting and disconnecting the dc voltmeter

Connect a dc voltmeter (20 kΩ/volt VOM set to measure at least −15 volts) between ground and the −1500 volt test point (pin 2 of the crt base-pin socket) Adjust R100, HV Adj, for −1500 volts. Tolerance of the high-voltage supply is −1500 V, ±30 V

Disconnect precision dc voltmeter



2. ADJUST CRT OPERATION

NOTE

Connect a positive-going sweep sawtooth from the ramp generator to the +X INPUT. Set the sweep rate for 0.5 millisecond/division and check for a horizontal sweep 10 graticule divisions in length. Adjust INTENSITY, FOCUS, and positioning as needed

a. CRT BIAS

Connect a voltmeter between ground and the collectors of Z-Axis Amplifier output transistors Q720 and Q724 Adjust the front-panel INTENSITY control to provide a voltmeter reading of 10 volts

Adjust R192 Cutoff, until the trace just disappears Then adjust the INTENSITY control for a trace of normal display brightness. Disconnect the dc voltmeter

b. ASTIGMATISM

Temporarily disconnect the sweep from the +X INPUT connector. Turn FOCUS control fully cw, then adjust R170, Astig, for a round spot

Reconnect the sweep signal and adjust the FOCUS control for optimum trace definition

c. TRACE ROTATION

Move the trace to the center of the graticule. Adjust R145, TRACE ROTATION control (located on the rear panel) to align the trace horizontally, using the horizontal graticule lines as a guide

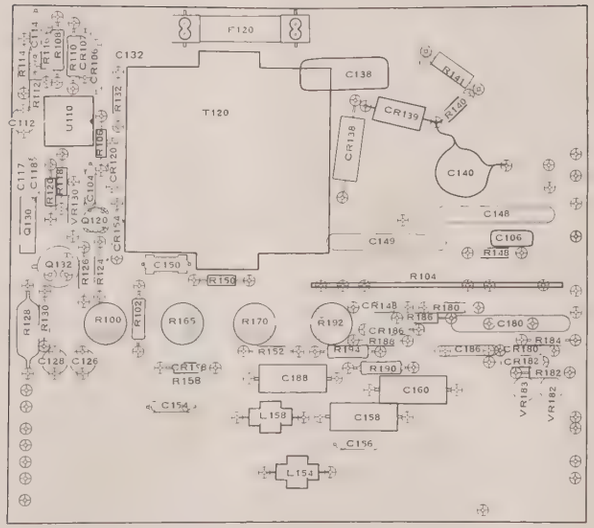
d. GEOMETRY

Position the trace first to the top of the graticule, then to the bottom. Bowing of the trace must not exceed 0.1 division at either position. Remove the positive-going sweep sawtooth signal from the +X INPUT and connect it to the +Y INPUT. Position the trace, first to the left of the graticule, then to the right. Bowing of the trace must not exceed 0.1 division at either position. Disconnect the positive-going sweep sawtooth signal from the +Y INPUT and connect it to the +X INPUT.

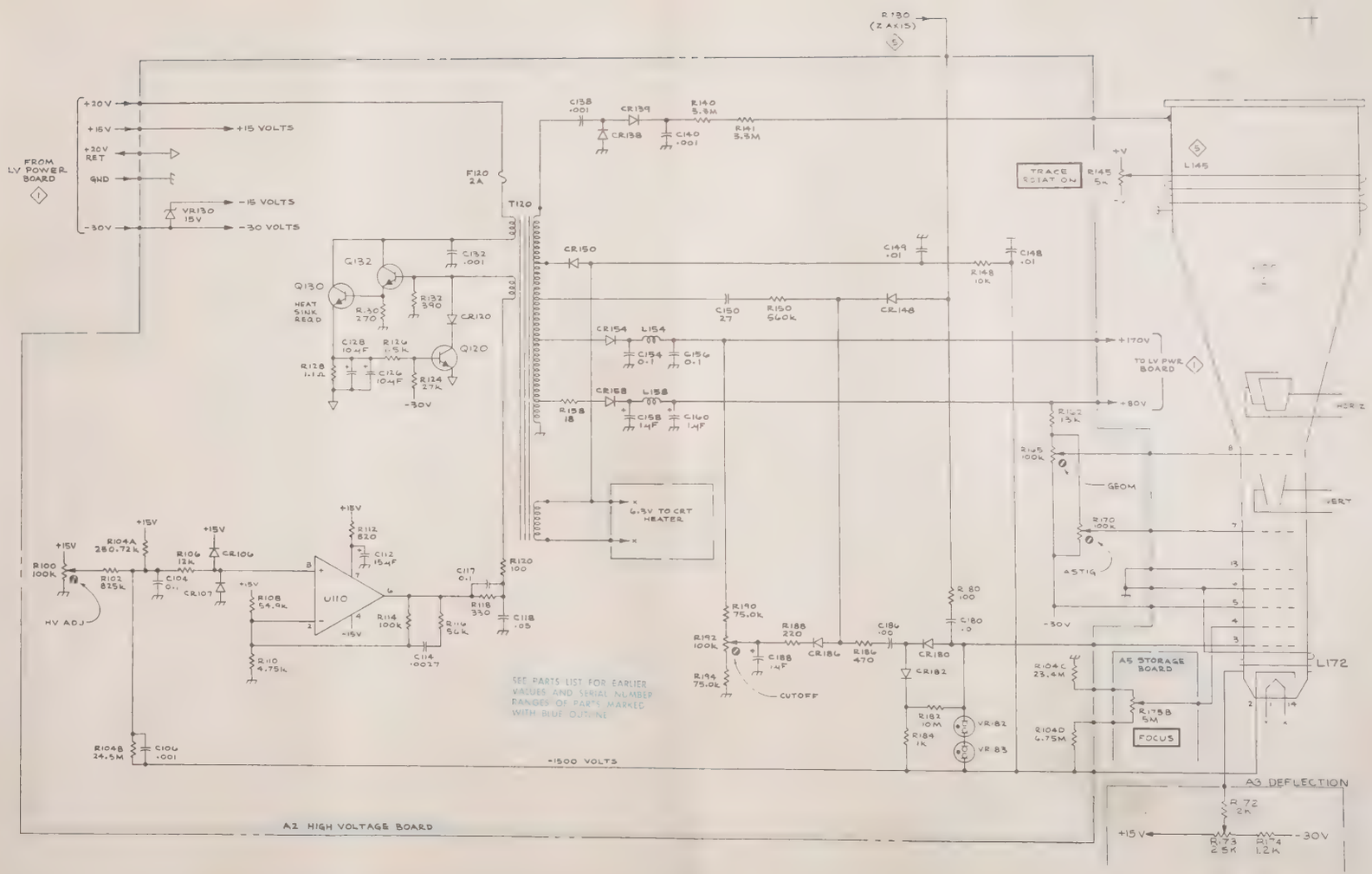
Adjust R165, Geom, for minimum curvature of the trace. Repeat bowing measurements as necessary to achieve best overall geometry adjustment. Some compromising of the geometry adjustment may be necessary to achieve both good focus and good geometry.

PARTS LOCATION GRID

CRT CIRCUIT



CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C104	B2	CR106	B1	R100	B3	R150	C3
C106	E3	CR107	A1	R102	B3	R152	C4
C112	A2	CR120	B2	R104	D3	R158	B4
C114	A1	CR138	D2	R106	B2	R165	B3
C104	B2	CR139	D2	R108	A1	R170	C3
C106	E3	CR148	D3	R110	A1	R180	E3
C112	A2	CR154	B3	R112	A1	R182	F4
C114	A1	CR158	B4	R114	A1	R184	F4
C117	A2	CR180	E4	R116	A1	R186	E3
C118	A2	CR182	E4	R118	A2	R188	D4
C126	A4	CR186	D4	R120	A2	R190	D4
C128	A4	F120	C1	R124	B3	R192	D3
C132	B1			R126	B3	R194	D4
C138	D1	L154	C5	R128	A3	T120	C2
C140	E2	L158	C4	R130	A3	U110	A2
C148	E2			R132	B1		
C149	D3	Q120	B2	R140	E1	VR130	A2
C150	B3	Q130	A2	R141	E1	VR182	F4
C154	B4	Q132	A3	R148	E3	VR183	E4
C156	D5						
C158	D4						
C160	D4						
C180	E3						
C186	E4						
C188	C4						



HIGH VOLTAGE & CRT CIRCUIT (2) DEM 0574

THEORY OF OPERATION DIAGRAM 3

X DEFLECTION AMPLIFIER

The X Deflection Amplifier provides a push-pull output suitable to drive the crt deflection plates. Input signals can be applied either single-ended or differentially.

Input Signals can be applied to either J200 (+) or J300 (−) as single-ended inputs, or to both connectors as a differential input. Also, a signal may be applied via pin 1 of J20 (remote program connector) to the + input. S200 (+) and S300 (−), internal switches for each input, allow a choice of either 1:1 or 5:1 attenuation of the input signal before it is applied to the gate(s) of field effect transistor (fet) Q210. The input 5X attenuators are frequency-compensated voltage dividers.

PREAMPLIFIER

The preamplifier stage employs a dual fet to provide a high input impedance. This stage consists of two identical feedback amplifiers, Q210A-Q220 and Q210B-Q320, which can be operated as either a paraphase amplifier (with single-ended input) or as a differential amplifier. A push-pull signal is produced at the collectors of Q220 and Q320. The fet gates are diode-clamped on negative-going overdrive signals, protecting the transistors in the amplifier. R215, X Gain, provides an adjustable amplification factor to allow a crt full-scale deflection range from 0.5 volt or less to 2.5 volts or more. This control is normally set for a nominal 1 volt for full-scale deflection.

OUTPUT AMPLIFIER

The output amplifier stage consists of two identical non-inverting operational amplifiers connected in a differential configuration. Q232 and Q332 provide constant current for input emitter followers Q230 and Q330. Q230 and Q330 receive the push-pull signal from the preamplifier stage, and the input signal is developed across the resistance between their emitters. The signal current is forced through R250 and R185, producing the deflection-plate drive signal at the collectors of Q264 and Q364. Q260 and Q360, whose bases are diode-limited to ensure quick overdrive recovery, provide the drive for the output transistors. The Q264-Q364 collectors are diode-clamped on negative-going overdrive signals.

Display positioning is accomplished by R240, which provides a shift in the constant-current source transistors, shifting the quiescent voltage. Capacitor C246 HF Comp provides frequency compensation. Custom bandpass limiting is provided by connecting a customer-selected capacitor between the two * points. S220 (Option 4 only) permits connecting the output amplifier either to the output of the preamplifier, X-Y switch position, or connecting the output amplifier to the output of a sweep circuit, Y-T switch position.

ADJUSTMENTS

X&Y DEFLECTION AMPLIFIERS

WARNING

Dangerous potentials exist at several points throughout this instrument. When the instrument is operated with the covers removed, do not touch exposed connections or components.

Disconnect power before cleaning the instrument or replacing parts.

EQUIPMENT REQUIRED

1. Test oscilloscope with compatible 1X probe, to monitor test signals and to provide a sweep-generating signal. Bandwidth, dc to 2MHz (to 8 MHz for checking Z-axis bandwidth); deflection factor, 0.2 to 5 volts/div with 2% accuracy; sweep rates, 0.5 ms and 20 μs/div (0.2 μs/div for checking Z-axis circuit). For example, a 5403/D40 Oscilloscope with 5A48 Dual Trace Ampl and 5B42 Delaying Time Base plug-ins.

2. Ramp generator having a sawtooth amplitude between +1 volt and +3 volts, and a +1 volt to +5 volt gate signal that is coincident with the sawtooth, and sweep rates from 10 μs to 0.5 ms. For example, a RG 501 Ramp Generator (operates in a TM 500-Series Power Module), or any other ramp generator meeting the requirements may be used.

3. Square-wave generator. Frequency, 1 kHz, 10 kHz, and 100 kHz; risetime, less than 50 nanoseconds; output amplitude, 1 volt. For example a PG 506 Square Wave Generator (operates in a TM 500-Series Power Module) or any other square-wave generator meeting the requirements may be used.

4. Leveled sine-wave generator. Frequency, 350 kHz to above 5 MHz; reference frequency, 50 kHz; output amplitude, from about 0.5 volt to about 5 volts, within 3% as frequency is varied. For example, a SG 503 Leveled Sine Wave Generator (operates in a TM 500-Series Power Module) or any other sine-wave generator meeting the requirements may be used.

5. Coaxial Cables (2). Impedance, 50 Ω; length, 42 inches; connectors, BNC. Tektronix Part No. 012-0057-01.

6. T connector, BNC. Tektronix Part No. 103-0030-00.

7. 5X attenuator (optional, depending on test equipment used). Impedance, 50 Ω; accuracy, within 2%; connectors, BNC. Tektronix Part No. 011-0060-02.

PRELIMINARY PROCEDURE

NOTE

The performance of this instrument can be checked at any temperature within the 0° C to +50° C range. Make any adjustment at a temperature of +25° C, ±5° c.

a. Check that the correct nominal line-selector block (120 VAC or 220 VAC) has been installed on the line selector pins and that the regulating range selected includes the input line voltage, see Installation section.

b. Check that the crt screen (display area) has a 8 X 10-division scribed graticule; install one if necessary.

c. Remove the outside cabinet panels to gain access to internal controls and test points.

d. Connect the Monitor to the line voltage source and apply power.

e. Set the following controls:

Internal attenuator Slide switches (Deflection Amplifier board)	1:1 (up position)
XY-YT (Deflection Amplifier board and Z Axis board in Option 4 instruments only)	XY (down and to left position)
POWER	PULL ON (knob pulled out)
PULL TO SAVE	Knob pushed in
PERSISTENCE/SAVE TIME	Fully ccw
STORE	Non-store (button out)
INTENSITY	As is
FOCUS	Midrange
OPERATE LEVEL	As is
Vertical Position	Midrange
Horizontal Position	Midrange

ADJUST AND CHECK VERTICAL (Y) AND HORIZONTAL (X) DEFLECTION SYSTEMS

NOTE

The X and Y gains should be adjusted for full-scale deflection, depending upon the input signals used. As an example, the following procedure shows the proper adjustment for one volt full-scale deflection on both axes. BE SURE TO PLACE GROUNDING CAPS ON UNUSED INPUTS.

Connect a positive-going sweep sawtooth from the ramp generator to the +X INPUT. Set the sweep rate for 0.5 millisecond/division and check for a horizontal sweep 10 graticule divisions in length. Adjust INTENSITY, FOCUS, and positioning as needed.

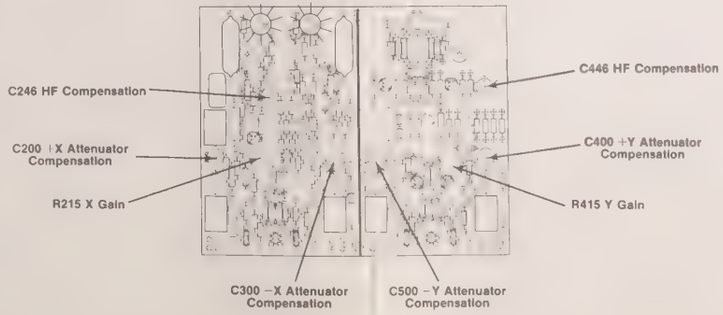
VERTICAL AXIS GAIN AND COMPENSATION

While applying the 0.5-millisecond/division sweep signal to the +X INPUT, apply a 1-kilohertz square-wave signal from the square-wave generator to the +Y INPUT through a coaxial cable between the T connector and the input to the test oscilloscope to monitor the square-wave signal. Set the test oscilloscope vertical deflection factor to 0.2 volt/division and adjust the square-wave generator for a 1-volt display amplitude (5 displayed divisions on the test oscilloscope). Use an attenuator if necessary

Adjust R415, Y Gain, for eight vertical divisions of square-wave display. Set slide switch S400 to X5 (down position)

Adjust C400, +Y Attenuator Compensation, for minimum roll-off or overshoot of the leading corner of the square-wave display. Set S400 back to the X1 position and move the square-wave signal to the −Y INPUT. Set slide switch S500 to X5

Adjust C500, −Y Attenuator Compensation, for optimum square-wave bottom. Set S500 back to the X1 position. Change the test oscilloscope sweep rate to 10 microseconds/division. Set the square-wave generator for a 0.7-volt, 100-kilohertz output and move the square-wave signal to the +Y INPUT



Adjust C446 HF Comp, for optimum square-wave bottom

HORIZONTAL AXIS GAIN AND COMPENSATION

Move the sweep signal to the +Y INPUT and the square-wave signal to the +X INPUT. Using the signals and conditions given in the Vertical Axis Gain and Compensation part of this step, adjust the following controls

R215, X Gain

C200, +X Attenuator Compensation (set S200 to X5)

C300, −X Attenuator Compensation (set S300 to X5)

C246, HF Comp

BANDWIDTH

Set the test oscilloscope sweep rate to 1 millisecond/division and replace the square-wave generator with the sine-wave generator. Adjust the sine-wave generator for eight vertical divisions of 50-kilohertz display as a reference. Then slowly increase the frequency until the display amplitude is 5.66 divisions. This is the upper −3 dB point. The frequency at the upper −3 dB point must be at least three megahertz

Move the sweep signal to the −X INPUT and the sine-wave signal to the +Y INPUT. Repeat the above paragraph to verify horizontal bandwidth

PHASE DIFFERENCE

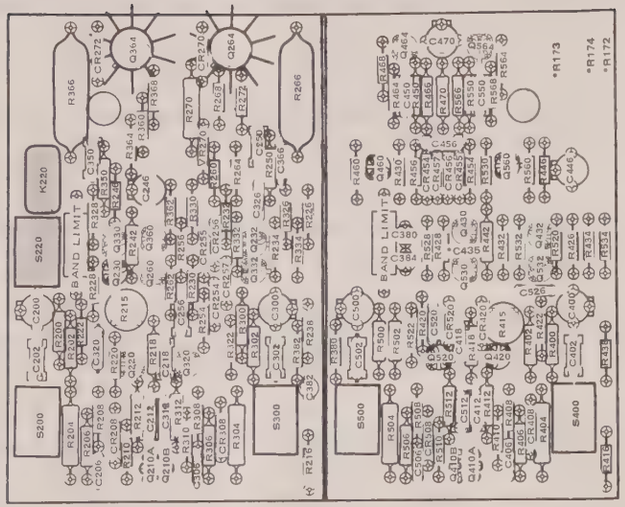
Remove the sweep signal and apply sine-wave signal to both the +Y and +X input. Adjust the sine-wave generator and positioning controls so that the display is a diagonal line running from the lower left-hand corner of the graticule to the upper right-hand corner. Adjust R215, X Gain, so the horizontal display width is 8 divisions, then set the sine-wave generator frequency to 500 kilohertz

Any opening of the loop indicates a phase shift. The vertical height of the opening at the center of the graticule should not exceed 0.1 division. If necessary, slightly adjust C446, and C246 to reduce phase shift. These adjustments will affect frequency response, if adjustment is necessary, repeat all of the above steps to obtain minimum phase shift with best frequency response

Adjust R215 X Gain, so the horizontal display width is 10 divisions, as it was before making the X-Y phasing check. Remove the sine-wave signal from the X and Y inputs

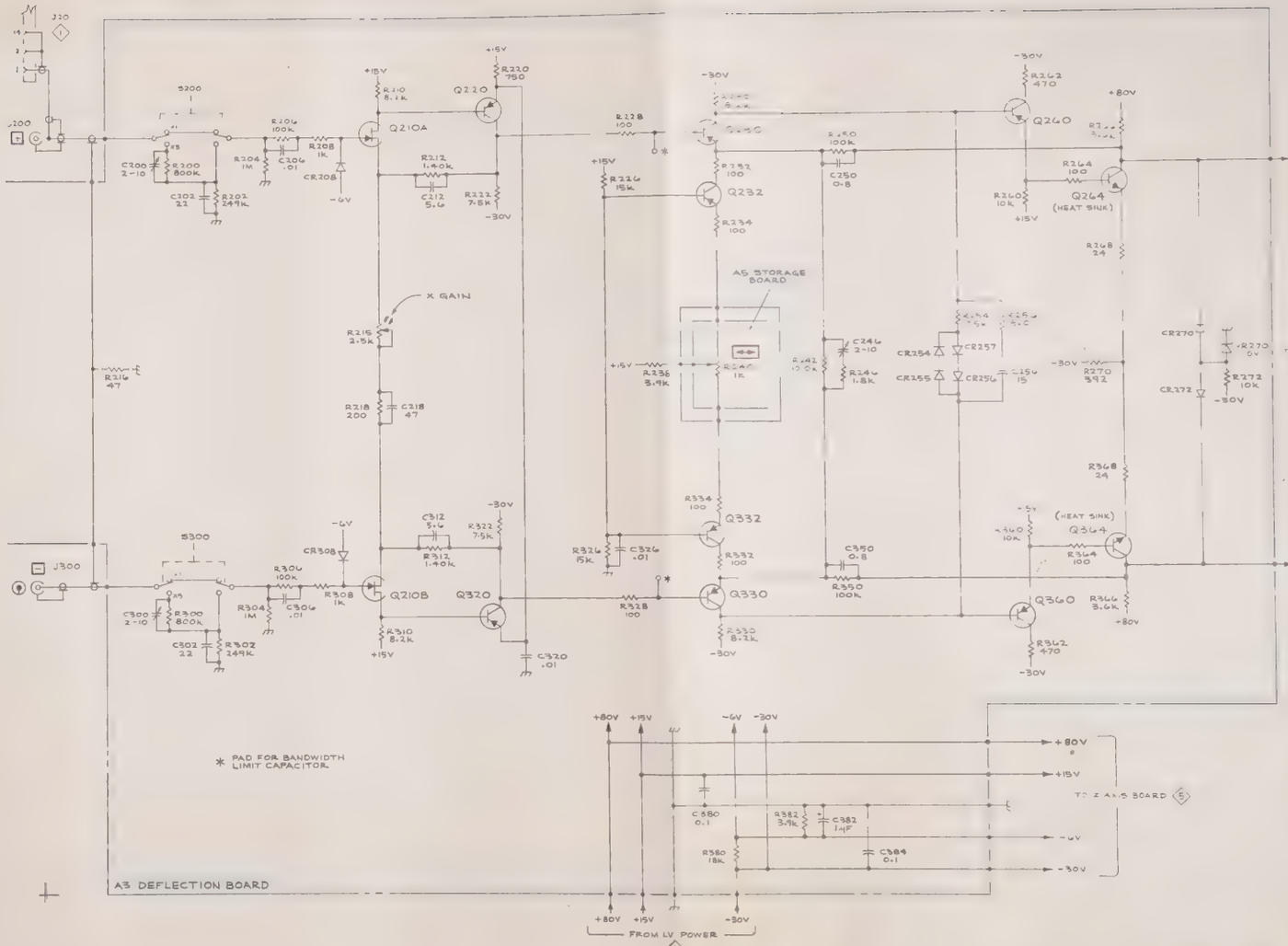
PARTS LOCATION GRID

DEFLECTION AMP



AREA INDICATES OPTION 4

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C200	A3	C415	E3	CR420	E3	Q460	D2	R230	B3	R326	C2	R422	F3	R512	E4
C202	A4	C418	E4	CR454	D2	Q464	D1	R232	C2	R328	A2	R426	F3	R522	D3
C206	B5	C446	F2	CR455	E2	Q520	E4	R234	C3	R330	B2	R428	E2	R526	F3
C212	B4	C450	D1	CR456	E2	Q530	E3	R238	C3	R332	C3	R430	D2	R528	E3
C218	B4	C465	E2	CR457	E2	Q532	F3	R242	B3	R334	C3	R432	E3	R530	E2
C246	B2	C470	E1	CR508	E4	Q560	E2	R246	B2	R350	B2	R434	F3	R532	E3
C250	C2	C500	D3	CR520	E3	Q564	E1	R250	C2	R360	B2	R438	F4	R534	F3
C256	B3	C502	D4			R172	F1	R254	B3	R362	B2	R442	E3	R550	E1
C300	C3	C506	D5	Q210	B5	R173	F1	R256	B3	R364	B2	R446	F2	R560	E2
C302	C4	C512	E4	Q220	B4	R174	F1	R260	C2	R366	A1	R450	D1	R564	E1
C306	B5	C520	E3	Q230	B3	R200	A3	R262	B3	R368	B1	R454	E2	R566	E1
C312	B4	C526	E3	Q232	C3	R202	A4	R264	C2	R380	D4	R456	D2	R568	E1
C320	B4	C550	E1	Q260	B3	R204	A4	R266	C1	R382	C4	R460	D2		
C326	C2			Q264	C1	R206	A4	R268	C1	R400	F4	R464	D1	S200	A4
C350	A2	CR208	B4	Q320	B4	R208	B4	R270	B1	R402	E4	R466	E1	S300	C4
C366	C2	CR254	C3	Q330	B3	R210	B4	R272	C1	R404	F4	R468	D1	S400	F4
C380	D3	CR255	B3	Q332	C3	R212	B4	R300	C3	R406	E4	R470	E1	S500	D4
C382	C4	CR256	C3	Q360	B3	R215	B3	R302	C4	R408	E4	R500	D4		
C384	D3	CR257	C3	Q364	B1	R216	C5	R304	C4	R410	E4	R502	D4	VR270	B2
C400	F3	CR270	B1	Q410	E5	R218	B4	R306	C4	R412	E4	R504	D4		
C402	F4	CR272	B1	Q420	E4	R220	B4	R308	B4	R416	F5	R508	D4		
C406	E5	CR308	C4	Q430	E3	R222	A3	R310	B4	R418	E4	R508	D4		
C412	E4	CR408	E4	Q432	F3	R226	C2	R312	B4	R420	D3	R510	E4		
						R228	A3	R322	C4						



HORIZONTAL (X) AMPLIFIER 3 DEM 0374

THEORY OF OPERATION DIAGRAM 4

Y DEFLECTION AMPLIFIER

The Y Deflection Amplifier provides a push-pull output suitable to drive the crt deflection plates. Input signals can be applied either single-ended or differentially.

INPUT

Signals can be applied to either J400 (+) or J500 (−) as single-ended inputs, or to both connectors as a differential input. Also, a signal may be applied via pin 15 of J20 (remote program connector) to the + input. S400 (+) and S500 (−) internal switches for each input, allow a choice of either 1:1 or 5:1 attenuation of the input signal before it is applied to the gate(s) of field-effect transistor (fet) Q410. The input 5X attenuators are frequency-compensated voltage dividers.

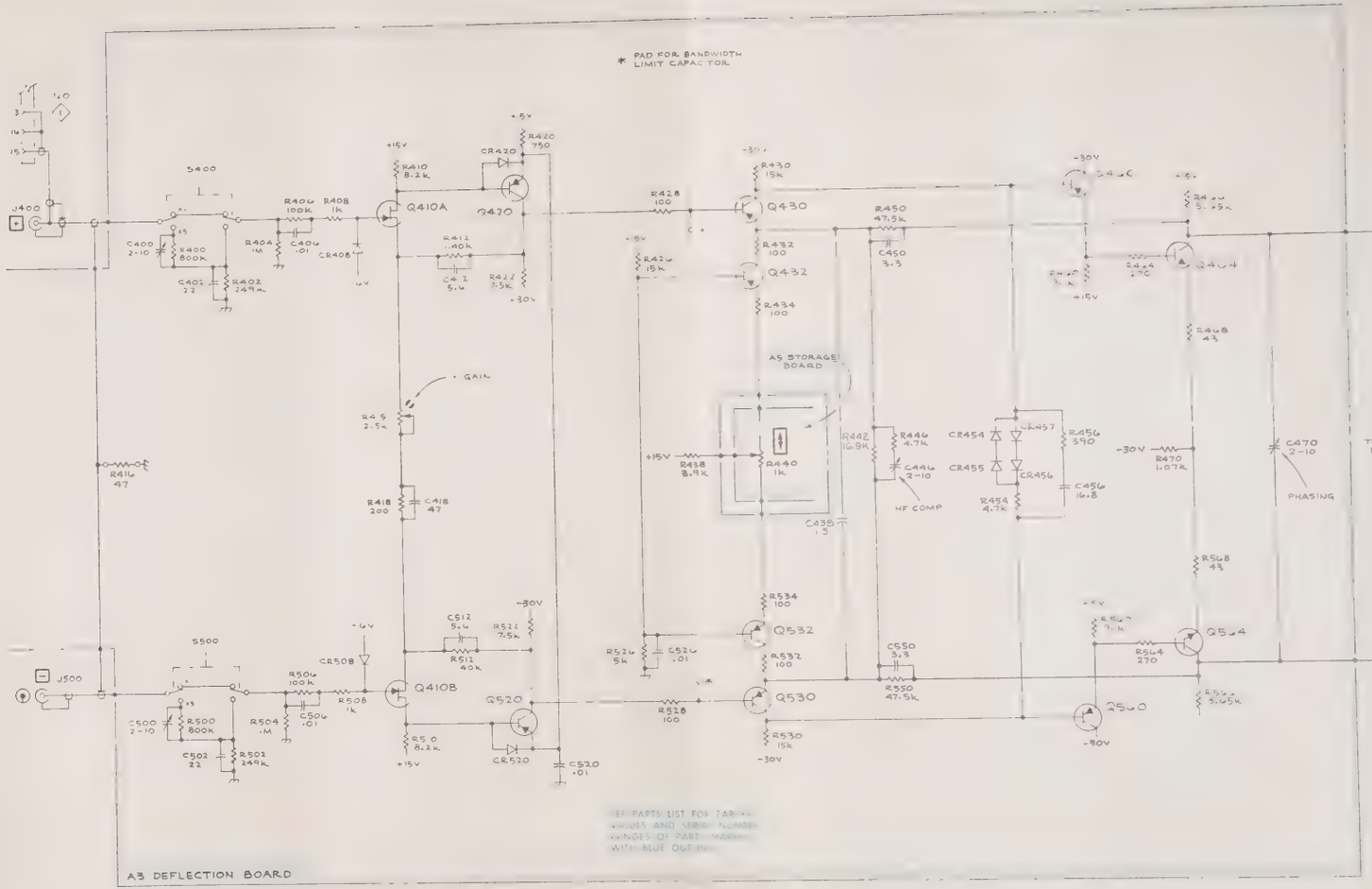
PREAMPLIFIER

The preamplifier stage employs a dual fet to provide a high input impedance. This stage consists of two identical feedback amplifiers. Q410A-Q420 and Q410B-Q520, which can be operated as either a paraphase amplifier (with single-ended input) or as a differential amplifier. A push-pull signal is produced at the collectors of Q420 and Q520. The fet gates are diode-clamped on negative-going overdrive signals, protecting the transistors in the amplifier. R415, Y Gain, provides an adjustable amplification factor to allow a crt full-scale deflection range from 0.5 volt or less to 2.5 volts or more. This control is normally set for a nominal 1 volt for full-scale deflection.

OUTPUT AMPLIFIER

The output amplifier stage consists of two identical non-inverting operational amplifiers connected in a differential configuration. Q432 and Q532 provide constant current for input emitter followers Q430 and Q530. Q430 and Q530 receive the push-pull signal from the preamplifier stage, and the input signal is developed across the resistance between their emitters. The signal current is forced through R450 and R550, producing the deflection-plate drive signal at the collectors of Q464 and Q564. Q460 and Q560, whose bases are diode-limited to ensure quick overdrive recovery, provide the drive for the output transistors.

Display positioning is accomplished by R440, which provides a shift in the constant-current source transistors, shifting the quiescent voltage. Capacitor C446 HF Comp provides frequency compensation. Custom bandpass limiting is provided by connecting a customer-selected capacitor between the two * points.



REV. B, OCT. 1974

VERTICAL (Y) AMPLIFIER 4 DEH 0374

THEORY OF OPERATION DIAGRAM 5

Z-AXIS AMPLIFIER

INPUT

Signals can be applied to either J600 (+) or J650 (−) as single-ended inputs, or to both connectors as a differential input. Also, a signal may be applied via pin 17 of J20 (remote program connector) to the + input. A provision is made on each input line to permit installation of attenuating resistors.

PREAMPLIFIER

The Z-axis preamplifier stage employs a dual field-effect transistor (fet) Q610 to provide a high input impedance. The stage consists of two identical feedback amplifiers, Q610A-Q620-Q630 and Q610B-Q670-Q680, which can be operated as either a paraphase amplifier (with a single-ended input) or as a differential amplifier. A single-ended output is produced at the collector of Q630, and is opposite in polarity to a signal applied to the + input and in phase with a signal applied to the − input. Constant current for the stage is supplied by Q640. The fet gates are diode-clamped on negative-going overdrive signals, protecting the transistors in the preamplifier. R615, Z Gain, provides an adjustable amplification factor to provide a maximum allowable crt grid drive when a signal from +1 volt or less to +5 volts or more is applied to the Z-input and the INTENSITY control in the output stage is set to about midrange. Under this condition, a zero-volt input cuts off visual intensity.

OUTPUT AMPLIFIER

The output amplifier is a noninverting operational amplifier consisting of Q690, Q710, Q727, and Q720. The feedback resistor is R734 while C734 provides a means of adjusting the amplifier response. Q724 and Q720 are connected as a collector-coupled complementary amplifier to provide a fast, linear output signal while consuming minimum quiescent power. The quiescent output level can be set by adjustment of the INTENSITY control R175A. The output is applied to the crt control grid circuit.

To prevent damage to the information being saved, Q700 gates the Z-axis amplifier off when the 605 is operated in the save mode.

WARNING

Dangerous potential exist at several points throughout this instrument. When the instrument is operated with the covers removed, do not touch exposed connections or components. Disconnect power before cleaning the instrument or replacing parts.

EQUIPMENT REQUIRED

1. Test oscilloscope with compatible 1X probe, to monitor test signals and to provide a sweep-generating signal. Bandwidth, dc to 2 MHz (to 8 MHz for checking Z-axis bandwidth); deflection factor, 0.2 to 5 volts/div with 2% accuracy; sweep rates, 0.5 ms and 20 μs/div (0.2 μs/div for checking Z-axis circuit). For example, a 5403/D40 Oscilloscope with 5A48 Dual Trace Ampl and 5B42 Delaying Time Base plug-ins.

2. Ramp generator having a sawtooth amplitude between +1 volt and +3 volts, and a +1 volt to +5 volt gate signal that is coincident with the sawtooth, and sweep rates from 10 μs to 0.5 ms. For example, an RG501 Ramp Generator (operates in a TM 500-Series Power Module) or any other ramp generator meeting the requirements may be used.

3. Square-wave generator. Frequency, 1 kHz, 10 kHz, and 100 kHz; risetime, less than 50 nanoseconds; output amplitude adjustable to 1 volt, both negative- and positive-going from ground. For example, a PG 506 Square Wave Generator (operates in a TM 500-Series Power Module) or any other square-wave generator meeting the requirements may be used.

4. Leveled sine-wave generator. Frequency 350 kHz to above 5 MHz; reference frequency, 50 kHz; output amplitude, from about 0.5 volt to about 5 volts, within 3% as frequency is varied. For example a SG 503 Leveled Sine Wave Generator (operates in a TM 500-Series Power Module) or any other sine-wave generator meeting the requirements may be used.

5. Coaxial Cables (2). Impedance, 50 Ω; length, 42 inches; connectors BNC, Tektronix Part No. 012-0057-01.

6. T connector, BNC. Tektronix Part No. 103-0030-00.

7. 10X probe. Connectors, BNC; length, 6 feet. For example, a Tektronix P6065 probe.

ADJUSTMENTS

Z-AXIS AMPLIFIERS

PRELIMINARY PROCEDURE

NOTE

The performance of this instrument can be checked at any temperature within the 0° C to +50° C range. Make any adjustment at a temperature of +25° C, ±5° C.

a. Check that the correct nominal line-selector block (120 VAC or 220 VAC) has been installed on the line selector pins and that the regulating range selected includes the input line voltage, see Installation section.

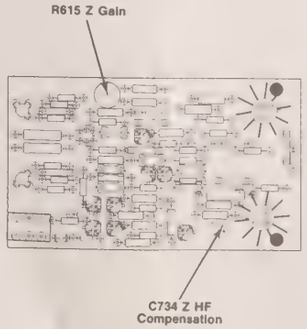
b. Check that the crt screen (display area) has an 8 X 10-division scribed graticule; install one if necessary.

c. Remove the outside cabinet panels to gain access to internal controls and test points.

d. Connect the Monitor to the line voltage source and apply power.

e. Set the following controls

Internal attenuator slide switches (Deflection Amplifier board)	1:1 (up position)
XY-YT (Deflection Amplifier board and Z Axis board in Option 4 instruments only)	XY (down and to left position)
POWER	PULL ON (knob pulled out)
PULL TO SAVE	Knob pushed in
PERSISTENCE/SAVE TIME	Fully ccw
STORE	Non-store (button out)
INTENSITY	As is
FOCUS	Midrange
OPERATE LEVEL	As is
Vertical Position	Midrange
Horizontal Position	Midrange



ADJUST AND CHECK Z AXIS AMPLIFIER

NOTE

The test oscilloscope should have a bandwidth of at least 8 MHz to permit checking the Z-Axis Amplifier bandwidth and making the HF compensation adjustment

Apply a 20-microsecond/division sweep signal to the +X INPUT. Apply a 50-kilohertz negative-going square-wave signal simultaneously to the +Z INPUT and to the test oscilloscope. Adjust the square-wave amplitude for one volt peak-to-peak. Set the INTENSITY control fully clockwise

Adjust R615, Z Gain, so the display appears as full-bright line segments that are completely blanked between segments. This indicates a full intensity control range of one volt. This procedure can be repeated using any voltage up to 5 volts to provide the intensity control range Reduce INTENSITY control setting, then remove the 50 kHz signal from the +Z INPUT

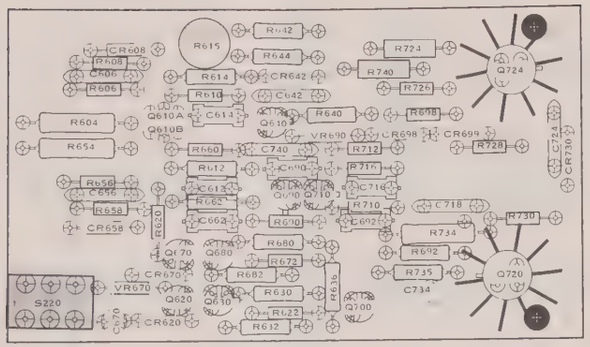
Connect a 10X probe between the collectors of Z-Axis Amplifier output transistors Q724 and Q720 and the test oscilloscope vertical input. Set the test oscilloscope vertical deflection factor to 5 volt/division and the sweep rate to 0.2 microsecond/division. Adjust the INTENSITY control for a 10-volt dc level at the Z-axis output. With a square-wave generator, apply a 100-kilohertz symmetrical positive-going square-wave to the +Z INPUT. Adjust the square-wave amplitude for 4 vertical divisions of test oscilloscope display

Adjust C734, Z HF Comp, for minimum roll-off or overshoot of leading edge of square-wave signal.

Replace the square-wave generator with the sine-wave generator to check the Z-axis bandwidth. Apply a 50-kilohertz sine wave to the +Z INPUT. Adjust the INTENSITY control for a 30-volt dc level at the Z-axis output Adjust the sine wave amplitude for a test oscilloscope disply of 8 vertical divisions. Then increase the frequency until the display amplitude is 5.66 divisions. This is the upper −3 dB point of the bandwidth. The frequency at the upper −3 dB should be at least 5 megahertz. Disconnect all test equipment.

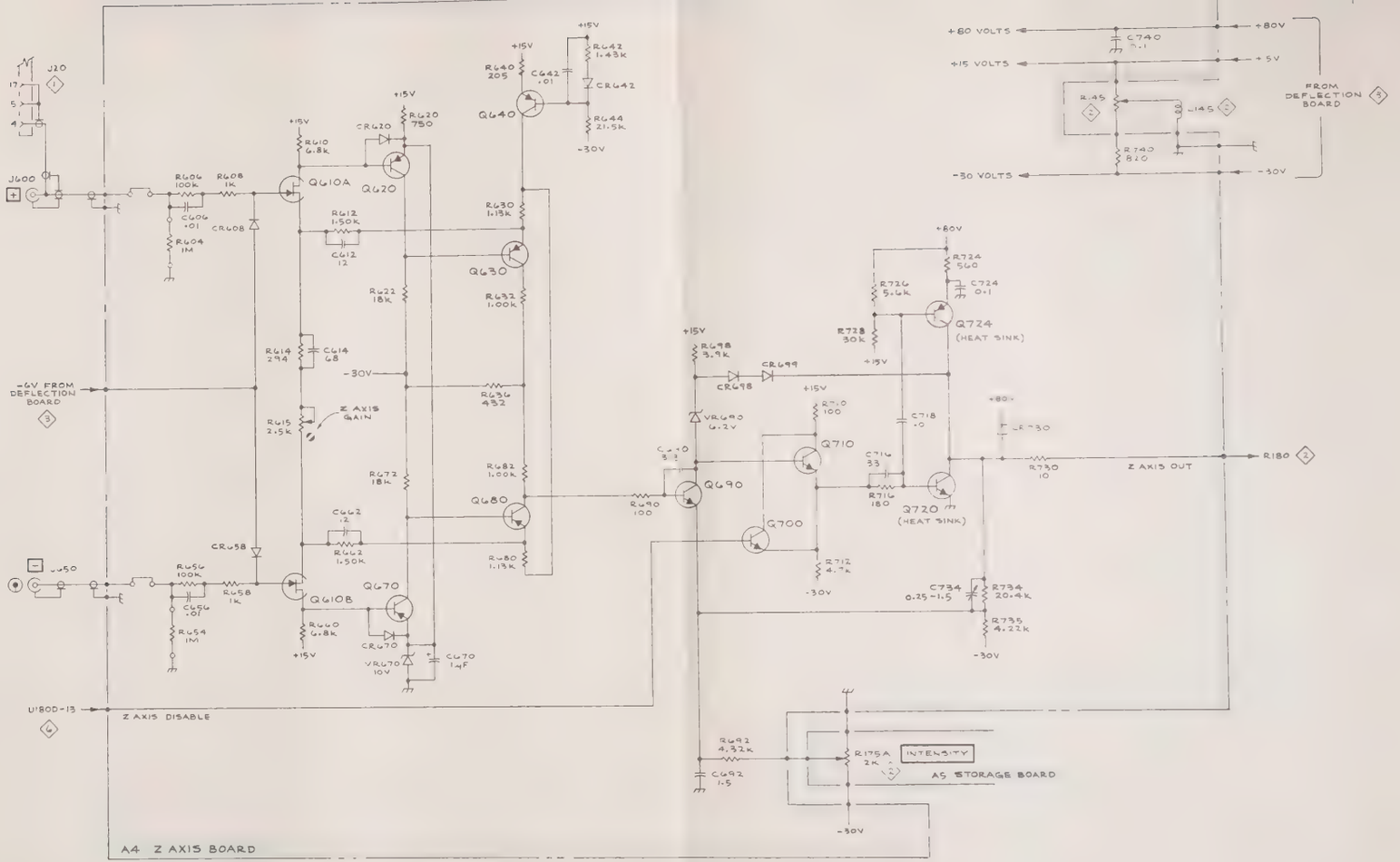
PARTS LOCATION GRID

Z AXIS AMP



AREA INDICATES OPTION 4

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C606	B1	CR608	B1	Q610	B2	R604	A2	R636	D3	R682	C3	R735	E3
C612	C3	CR620	B4	Q620	B4	R606	B2	R640	D2	R690	C3	R740	D2
C614	C2	CR642	C2	Q630	C4	R608	B1	R642	C1	R692	E3		
C642	C2	CR658	B3	Q640	C2	R610	C2	R644	C1	R698	E2	VR670	B3
C656	B3	CR670	B3	Q670	B3	R612	C2	R654	A2	R710	D3	VR690	D2
C662	C3	CR698	D2	Q680	C3	R614	C2	R656	B3	R712	D2		
C670	B4	CR699	E2	Q690	C3	R615	C1	R658	B3	R716	D2		
C690	C2	CR730	F2	Q700	D4	R620	B3	R660	C2	R724	D1		
C692	D3			Q710	D3	R622	C4	R662	C3	R726	E2		
C716	D3			Q720	E3	R630	C3	R672	C3	R728	E2		
C718	E3			Q724	E2	R632	C4	R680	C3	R734	E3		
C724	F2												
C734	D3												
C740	C2												



THEORY OF OPERATION DIAGRAM 6 & 7

STORAGE CIRCUIT

The Cathode-Ray tube is a standard transmission halftone storage tube. The collector mesh is a coarse mesh that accelerates electrons toward the target area. The target (storage mesh) is a fine mesh with a highly insulative dielectric layer deposited on it. It is in the dielectric layer that storage occurs. The flood guns cover the entire storage target with a continuous stream of low velocity electrons; these electrons are prevented from reaching the phosphor screen unless a display has been written on the storage mesh.

When the 605 is placed in the non-store mode, either remotely or by using the STORE pushbutton, pin 10 of U810C goes high. Q990 is turned on by U810C going high and Q996 is turned off by Q990 but only after about a 50 ms delay caused by CR1000 and R1000, which couples the output of U820. Changing the storage mode initiates an erase cycle, with the 50 ms delay being necessary to ensure that the storage mesh is in the proper electrical condition for non-store operation.

STORAGE ELEMENT SUPPLIES

The storage element supply circuits provide operating and control voltages for the storage and flood-gun crt elements.

FLOOD-GUN CATHODE. Q990 and Q996 form a clamped switching circuit whose control signals were described earlier. When Q996 is on, the flood-gun cathode is held at +15 V and cathode current flows. With Q996 off, the flood-gun cathode is positive with respect to the flood-gun anode, and no cathode current flows.

FLOOD-GUN ANODE. Q1010 forms a shunt regulator whose output voltage is set by R1014 and R1012 to about +35 V. During an erase cycle, the flood-gun anode voltage is raised by the added current supplied by R1018. Normally, the additional R1018 current is supplied to pin 1 of U850, however, when the output (pin 1) of U850 goes low for the duration of the erase cycle, CR1018 turns off, CR81016 turns on and the current is supplied to Q1010 base.

CE1-2. Q1036 forms a shunt regulator, with R1034, R1032 and R1030, with CE1-2 control setting the output voltage. When the 605 is changed from store to non-store mode, Q0126 is turned on, switching to ground the additional current from the base of Q1036 through R1026. This raises the collimation electrode voltage.

COLLECTOR MESH AND CE3. Emitter follower Q1050 and divider resistors R1054 and R1052 set the collector mesh element voltage to about +100 V. Voltage divider resistors R1040 and R1045, with CE3 control provides an adjustable voltage for the collimation electrode.

STORAGE MESH. Q1060 and Q1066 make up a shunt regulated supply. The output dc level of the supply is set by R970, OPERATE LEVEL and R965, Level Adj. controls.

In addition to the input signals mentioned earlier that modulate the supply during erase cycle and variable persistence modes of operation, an additional input in the form of a modified ramp is made to the summing point (base of Q1060). The modified ramp provides more consistent storage performance and is suppled from the relaxation oscillator Q872-Q876.

ERASE GENERATOR

The Erase Generator consists of three timing circuits, the outputs of which are summed together to form composite erase pulse T1 in Fig. A. The 50 ms, approximately 120 V pulse T1 is derived from monostable multivibrator U1. At the end of T1, T2 (Fig. A), which is formed by rc network R838-C840 and switching transistor Q835, returns the storage mesh to 0 V for approximately 10 ms. T3 (Fig. A), which is initiated at the start of T1, maintains control over the storage mesh after T1 and T2 have passed and sets the storage mesh prep level for the remainder of the erase cycle. T1, T2 and T3 signals control diode gates CR952, CR954 and CR956, which in turn supply the control currents to the summing point at the base of Q1060. Q1060 and Q1066 form an operational amplifier that is used as a current-to-voltage conversion amplifier to control the storage mesh.

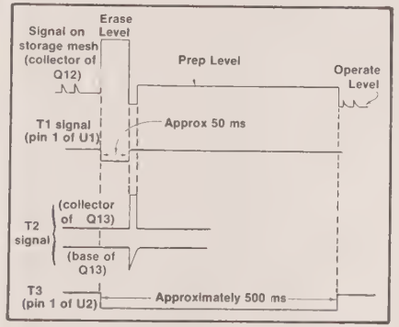


Fig. A. Idealized waveform ladder showing the outputs of the Erase Generator.

Pin 6 of U85D drives U810A, the output of which becomes the Erase Interval Out signal. The output from U810A is also used as a lockout signal for U820 and U895 when the 605 is used in the variable persistence mode of operation. U895 generates variable width pulses to control the storage mesh persistence.

VARIABLE PERSISTENCE PULSE GENERATOR

Q872 and Q876 are connected as a relaxtion oscillator that generates sharp positive pulses, see Fig. B, at a 100 Hz rate. The timing components for the relaxation oscillator are R875 and C886. The sharp positive pulses from the emitter of Q876 are used to trigger monostable multivibrator U895. The on time of U895 is controlled by C895, R892, R894 and R895 PERSISTENCE/SAVETIME control. The output of U895 controls diode gate CR6, which subtracts current from the summing point at the base of Q1060m thus causing the U895 output to modulate the storage mesh. The amount of current to be subtracted is set by R975 Pulse Height control.

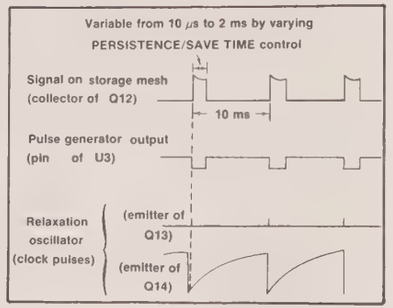

Variable from 10 μs to 2 ms by varying PERSISTENCE/SAVE TIME control
Signal on storage mesh (collector of Q12)
10 ms
Pulse generator output (pin of U3)
Relaxation oscillator (clock pulses)
(emitter of Q13)
(emitter of Q14)

Fig. B. Idealized waveform ladder showing the output and internal clock pulses of the Variable Persistence Pulse Generator.

Turning the PERSISTENCE/SAVE TIME control fully counterclockwise (maximum persistence position) closes S895, grounding the output of the relaxtion oscillation through R882, thereby preventing U895 from being triggered.

Pulling the PULL TO SAVE knob causes the output of U895 to be steered to the flood-gun cathode. This is accomplished by using the output of U810D. With the output of U895 modulating the flood-gun cathode current instead of the storage mesh, the stored image can now be observed, without complete loss of the save feature by adjusting the PERSISTENCE/SAVE TIME control. The maximum average flood-gun cathode current corresponds to the fully clockwise position (minimum persistence) of the PERSISTENCE/SAVE TIME control. When the PERSISTENCE/SAVE TIME control is fully counterclockwise, U895 is not triggered and the flood-gun cathode current is zero resulting in maximum save time. During the time U895 is not triggered (PERSISTENCE/SAVE TIME control fully counterclockwise), the flood-gun cathode sets positive with respect to the flood-gun anode level, which is approximately +35 V, and no flood-gun cathode current flows (Q996 is turned off).

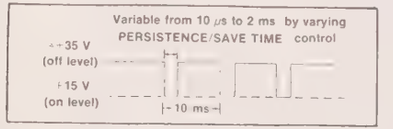


Fig. C. Waveform on flood-gun cathode when 605 is in save mode.

The collimation bands (electrodes) are used as a lens that uniformly distributes flood-gun electrons over the storage target area. In the non-store mode, the collimation bands have no control over the crt.

Switching from the non-store mode to the store mode is done by either pushing the front-panel STORE pushbutton, or by applying a TTL low level to pin 6 of J20. When changing modes from non-storage to storage operation, an erase cycle is generated automatically.

NOTE

While the presence of the modified ramp produces more consistent performance over the entire storage area at lower writing speed requirements, some improvement of image contrast, under specific conditions, may result if the waveform is not present. Jumper 988 disconnects the waveform from the storage mesh circuit.

INPUT-OUTPUT GATES

U810A, U810C and U810B provide inputs and outputs for remote programming of the 605. R802-R808-R852-R853-R912-R906, and CR802-CR852-CR853-CR910-CR912 provide limited protection against accidental line transients as an additional voltage drop is introduced. A low logic level of ≤0.52 V is required for reliable operation. Since nearly all TTL outputs specify a 0.4 V maximum for the low logic level, the 605 gates are compatible with most TTL logic systems.

NOTE

If low logic levels of ≤0.8 V are required, the current limiting resistors may be replaced with jumpers. However, since the diodes will no longer have any current limiting, transient protection will be severly reduced.

ERASE INITIATE CIRCUIT

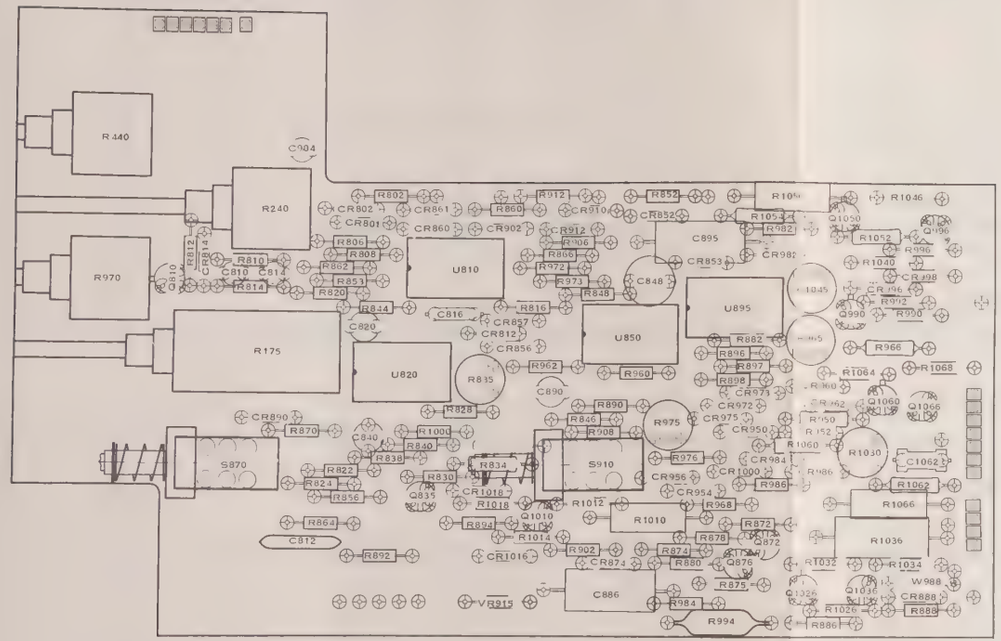
The output of U810B is used to trigger U820 to initiate an erase cycle. If the front-panel ERASE pushbutton is held depressed longer than one erase cycle, the erase cycle will repeat, therefore, this is a way to achieve multiple erase cycles to clear a crt of such problems as residual images.

When an erase cycle is initiated pin 1 of U850 goes negative causing C890 to discharge through CR890. When pin 1 of U850 returns positive, at the end of the erase cycle, C890 momentarily pulls pin 6 of U810B positive, then recharges negative because of the current in R870. As the U810B pin 6 input swings to its low level, the output of U810B pin 4 goes high again triggering U820. This cycle will repeat as long as the front-panel ERASE pushbutton is depressed. Multiple erase cycles cannot be obtained when using the remote erase feature.

Q810 along with C814 and C810 form a circuit to initiate an erase cycle whenver the 605 storage mode is changed, that is, from store to non-store or vice versa. Switching to the non-store mode causes pin 10 of U810C to go high, turning on Q810, which in turn pulls pin 6 of U810B low through C810, thereby initiating an erase cycle. Also, pin 3 of U820 is pulled high through CR812 by pin 10 of U810C to disable U820 and prevent unwanted erase cycles. If the mode is changed to store, pin 10 of U810C goes low, pulling pin 6 of U820 low through CR814 and C814. C814 is large enough so that pin 4 of U820 has time to drop and enable U820 before the erase initiation pulse has disappeared.

PARTS LOCATION GRID

STORAGE BD



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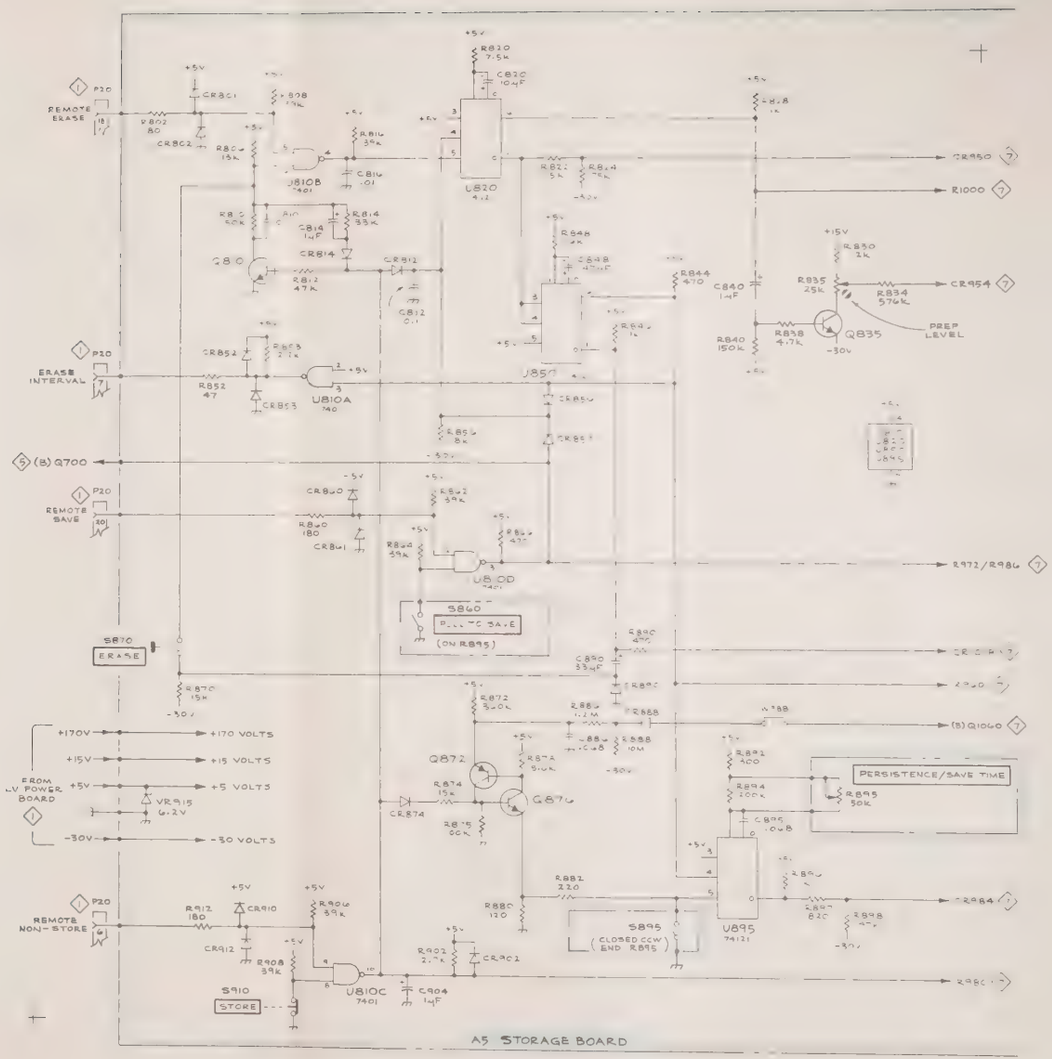
C810	C3	CR801	D2	CR890	C4	CR973	G4	Q835	D5	R175	C4	R828	E4	R860	E2	R888	I6	R960	F4	R986	G5	R1032	H6	R1066	H5
C812	C5	CR802	D2	CR902	E3	CR975	G4	Q872	G5	R240	C2	R830	D5	R862	C3	R890	F4	R962	E4	R990	I3	R1034	I6	R1068	I4
C814	C3	CR812	E4	CR910	F2	CR982	G3	Q876	G6	R802	D2	R834	E5	R864	C5	R892	D6	R965	H4	R992	I3	R1036	H5		
C816	D3	CR814	B3	CR912	F3	CR984	G5	Q890	H3	R806	D3	R835	E4	R866	E3	R894	E5	R966	H4	R994	G6	R1040	H3	S870	B5
C820	D3	CR852	F2	CR950	G4	CR986	H5	Q990	H3	R808	D3	R838	D5	R870	C4	R896	G4	R968	G5	R998	I3	R1045	H3	S910	F5
C840	D4	CR853	G3	CR952	H4	CR996	H3	Q996	I3	R810	C3	R840	D5	R872	G5	R897	G4	R970	A3	R1000	D4	R1046	I2		
C848	F3	CR856	E4	CR954	G5	CR998	I3	Q1010	E5	R812	B3	R844	D3	R874	F5	R898	G4	R972	E3	R1010	F5	R1050	G2	U810	D3
C886	F6	CR857	E3	CR956	F5	CR1000	G5	Q1026	H6	R814	C3	R846	F4	R875	G6	R902	F5	R973	F3	R1012	F5	R1052	H3	U820	D4
C890	E4	CR860	D3	CR960	H4	CR1016	E6	Q1036	H6	R816	E3	R848	F3	R878	G5	R906	F5	R975	F4	R1014	E5	R1054	G2	U850	F4
C895	G3	CR861	D2	CR962	H4	CR1018	E5	Q1050	H2	R820	C3	R852	F2	R880	G6	R908	F4	R976	G5	R1018	E5	R1060	H5	U895	G3
C904	C2	CR874	F6	CR968	G5			Q1060	H4	R822	C5	R853	D3	R882	G4	R912	E2	R982	G3	R1026	H6	R1062	I5		
C1062	I5	CR888	I6	CR972	G4	Q810	B3	Q1066	I4	R824	C5	R856	C5	R886	H6	R950	H4	R984	G6	R1030	H5	R1064	H4	VR915	E6



605

REV. B, OCT 1974

STORAGE PULSE GENERATION AND CONTROL

ADJUSTMENTS 6 & 7
STORAGE CIRCUIT

WARNING

Dangerous potentials exist at several points throughout this instrument. When the instrument is operated with the covers removed, do not touch exposed connections or components.

Disconnect power before cleaning the instrument or replacing parts.

EQUIPMENT REQUIRED

1. Test oscilloscope with compatible 1X probe, to monitor test signals and to provide a sweep-generating signal. Bandwidth, dc to 2 MHz (to 8 MHz for checking Z-axis bandwidth); deflection factor, 0.2 to 5 volts/div with 2% accuracy; sweep rates, 0.5 ms and 20 μs/div (0.2 μs/div for checking Z-axis circuit). For example, a 5403/D40 Oscilloscope with 5A48 Dual Trace Ampl and 5B42 Delaying Time Base plug-ins.

2. 10X Probe. For example, a Tektronix P6065 Probe or any probe compatible with the vertical input of the test oscilloscope.

PRELIMINARY PROCEDURE

NOTE

The performance of this instrument can be checked at any temperature within the 0° C to +59° C range. Make any adjustment at a temperature of +25° C, ±5%C.

a. Check that the correct nominal line-selector block (120 VAC or 220 VAC) has been installed on the line selector pins and that the regulating range selected includes the input line voltage, see Installation section.

b. Remove any input signals from the 605.

c. Remove the outside cabinet panels to gain access to internal controls and test points.

d. Connect the Monitor to the line voltage source and apply power.

e. Set the following controls:

Internal attenuator slide switches (Deflection Amplifier board)	1:1 (up position)
XY-YT (Deflection Amplifier board and Z Axis board in Option 4 instruments only)	XY (down and to left position)
POWER	PULL ON (knob pulled out)
PULL TO SAVE	Knob pushed in
PERSISTENCE/SAVE TIME	Fully ccw
STORE	Store (button in)
INTENSITY	As is
FOCUS	Midrange
OPERATE LEVEL	Fully cw
Vertical Position	Midrange
Horizontal Position	Midrange

1. CE1-2 and CE3, R1030 and R1045.

Adjust R1030, CE1-2 and R1045 CE3 alternately until the brightened storage area does not have any shadowed corners or scallops.

2. OPERATE LEVEL, Prep Level and Level Adj R970, R835 and R965

Connect a 10X probe from a test oscilloscope to the operate level test point. Set the oscilloscope controls for a dc-coupled vertical deflection of 10 V/div and a free-running sweep with a 0.1 ms/div sweep rate.

Note the dc level of the operate level, then hold the ERASE Pushbutton in and observe the prep level. The prep level is the level the test oscilloscope remains at during most of the erase cycle. Adjust R835, Prep Level until the prep level observed on the test oscilloscope is the same as the operate level. Release the ERASE pushbutton after adjustment.

Adjust R965, Level Adjust ccw until the noted test oscilloscope operate level is lowered by five volts. Push the ERASE pushbutton and check for a clean erase. (Crt birghtness should be significantly lower than it was and there should not be any large bright areas.) If a clean erase is not obtained, lower the prep level to the present operate level and repeat this paragraph until a clean erase is obtained.

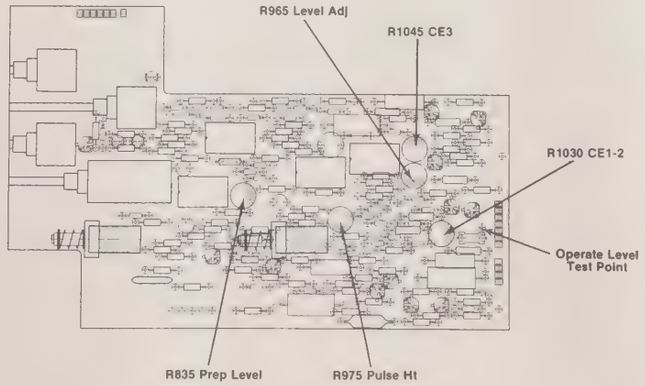
After a clean erase is obtained, adjust R835, Prep Level ccw in small increments, pushing the ERASE pushbutton after each incremental change, until a slight glow remains after the erase cycle

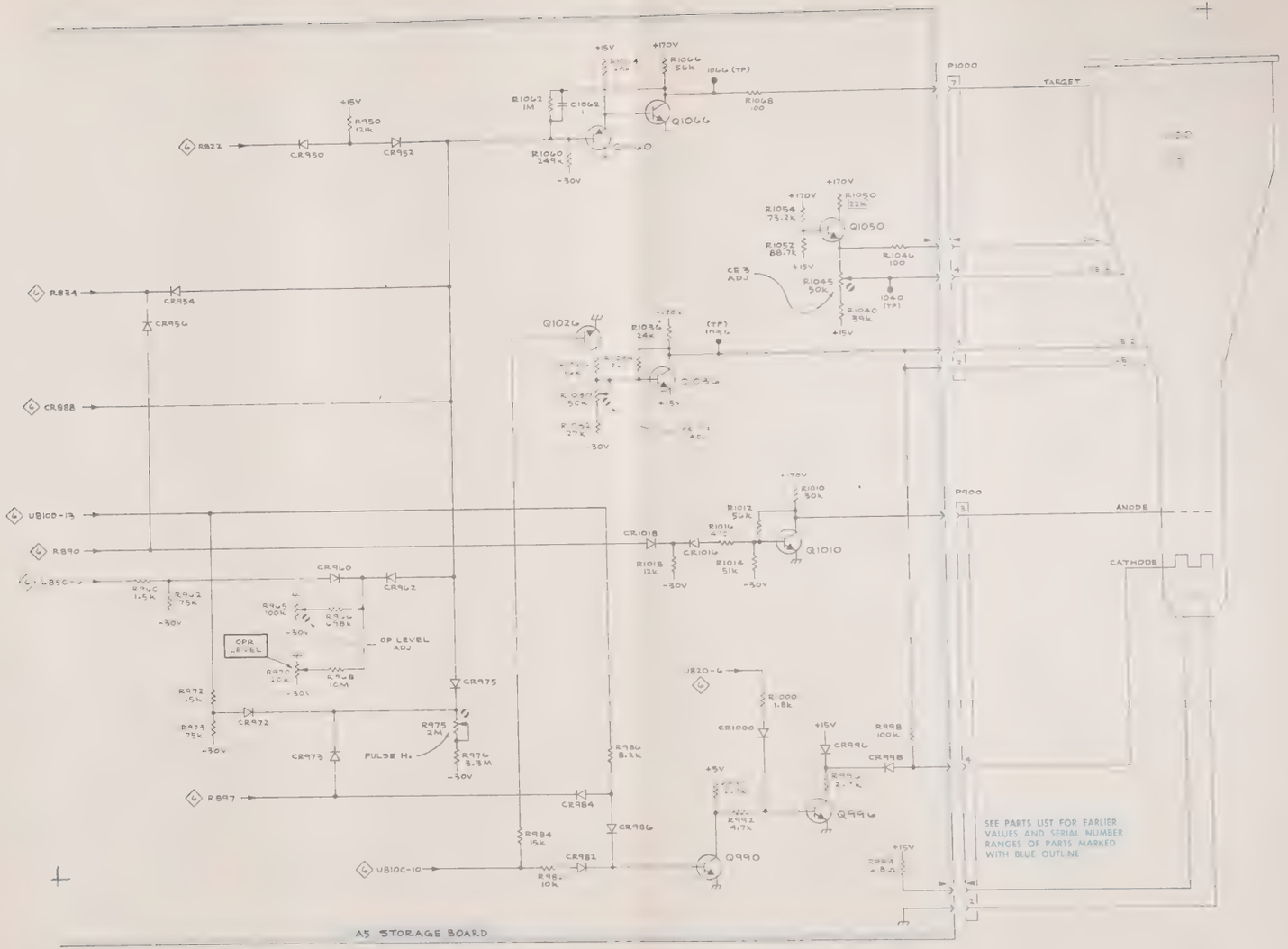
3. Pulse Ht, R975

With the test oscilloscope still connected as in step 2, turn the PERSISTENCE/SAVE TIME control cw until a waveform is displayed on the test oscilloscope.

Adjust R975 Pulse Ht until the top of the waveform is one volt above the prep level on the oscilloscope. The ERASE pushbutton will have to be pushed to observe the prep level.

Disconnect the test oscilloscope and 10X probe.





REV. B. OCT. 1974

STORAGE CRT CIRCUIT ⟨7⟩ DEM 0974

ADJUSTMENTS OPTION 4

Adjustment is generally required after a repair has been made, or after long time intervals in which normal aging of components may affect instrument accuracy.

Before complete calibration, thoroughly clean and inspect this instrument as outlined in the Service Information section of this manual. The Service Information section also contains information for general maintenance of this instrument, including preventive maintenance, component identification and replacement, etc.

SERVICES AVAILABLE

Tektronix, Inc. provides complete instrument repair and calibration at local Field Service Centers and at the Factory Service Center. Contact your local Tektronix Field Office or representative for further information.

WARNING

Dangerous potentials exist at several points throughout this instrument. When the instrument is operated with the covers removed, do not touch exposed connections or components. Disconnect power before cleaning the instrument or replacing parts.

EQUIPMENT REQUIRED

1. Leveled sine-wave generator. Frequency 350 kHz to above 5 MHz; reference frequency, 50 kHz; output amplitude, from about 0.5 volt to about 5 volts, within 3% as frequency is varied. For example, an SG 503 Leveled Sine Wave Generator (operates in a TM 500-Series Power Module) or any time-mark generator meeting the requirements may be used

2. Time-mark generator (for checking optional sweep timing). Marker outputs, 1 μs to 0.1 s; marker accuracy, within 0.1%. For example, a TG 501 Time Mark Generator (operates in a TM 500-Series Power Module) or any time-mark generator meeting the requirements may be used.

3. Coaxial cable. Impedance, 50 Ω; length, 42 inches; connectors, BNC. Tektronix Part No. 012-0057-01.

4. In line termination. Impedance, 50 Ω; accuracy, ±2%; connectors, BNC. Tektronix Part No. 011-0049-01.

PRELIMINARY PROCEDURE

NOTE

The performance of this instrument can be checked at any temperature within the 0° C to +50° C range. Make any adjustment at a temperature of +25° C ±5° C.

a. Check that the correct nominal line-selector block (110 VAC or 220 VAC) has been installed on the line selector pins and that the regulating range selected includes the input line voltage, see Installation section.

b. Check that the crt screen (display area) has an 8 x 10 division scribed graticule; install one if necessary.

c. Remove the outside cabinet panels to gain access to internal controls and test points.

d. Connect the Monitor to the line voltage source and apply power.

e. Set the following controls:

Internal attenuator slide switches (Deflection Amplifier board)	1:1 (up position)
XY-YT (Deflection Amplifier board and Z Axis board)	YT (up and far right position)
Norm Auto (Sweep board)	Auto (rear position)
POWER	PULL ON (knob pulled out)
PULL TO SAVE	Knob pushed in
PERSISTENCE/SAVE TIME	Fully ccw
STORE	Non-store (button out)
INTENSITY	As desired
FOCUS	As desired
OPERATE LEVEL	As is
Vertical Position	Midrange
Horizontal Position	Midrange
SEC/DIV	1 μ
VARIABLE	Fully cw

ADJUST AND CHECK OPTION 4 SWEEP GENERATOR

NOTE

If sweep is disconnected, reconnect by reversing order of the disconnect procedure outlined in the note under Preliminary Procedure on the Adjustments pull-out pages.

Set the internal XY-YT switch on the Deflection Amplifier board to the YT (up) position and the Z Axis board XY-YT switch to its YT (right) position. Set the Norm-Auto switch on the Sweep board to Auto (rear position). Set the front-panel SEC/DIV switch to 1 μ.

Adjust R1115, Sweep Length, so the sweep is about 10.5 divisions in length. Check the sweep timing over middle eight divisions. The distance between the second and tenth markers must be 8 divisions, ±0.24 division (±3%); if not adjust R1165, Sweep Cal, so the second and tenth markers are exactly 8 divisions apart.

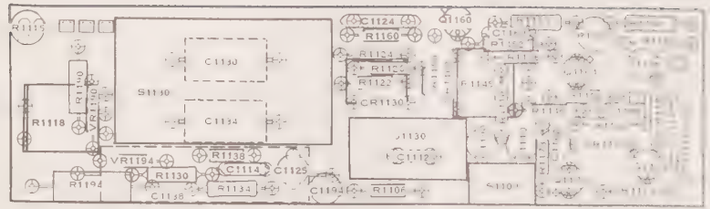
Check the timing accuracy of the other five positions of the SEC/DIV switch using time markers that correspond to each switch position. Accuracy is ±3%. Disconnect all test equipment.

NOTE

When changing from Sweep operation to XY operation, it is necessary to set the XY-YT switches S220 and S735 to the XY position. S220 is located on the Deflection Amplifier board, while S735 is located on the Z Axis board.

Apply a 2-megahertz signal from the sine-wave generator to the +Y INPUT. Adjust the sine-wave generator for 0.5 division of vertical deflection. Check that a stable display can be obtained by rotating the TRIG SLOPE/LEVEL control. Disconnect the sine-wave generator. Set the SEC/DIV switch to 1 m, and VARIABLE screwdriver control fully clockwise.

Apply one-millisecond markers from the time-mark generator via a coaxial cable and 50 Ω termination to the +Y INPUT. The displayed time markers should be between 2 and 6 divisions in amplitude; use attenuators if necessary. Position the first marker to the left edge of the graticule. Check for one 1 ms marker per major graticule division.



CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C1105	F2	CR1130	D2	R1120	D1	R1158	F1	S1109	E2
C1110	E2	CR1175	F2	R1122	D1	R1160	D1	S1130	B1
C1112	D2			R1124	D1	R1162	G1		
C1114	C2	Q1160	E1	R1130	B2	R1165	F1		
C1124	D1	Q1164	F1	R1134	C2	R1167	F1		
C1125	C2	Q1175	F2	R1138	C2	R1171	G2	U1130	D2
C1130	C1	Q1178	F2	R1145	E1	R1173	F2		
C1134	G2			R1146	F2	R1175	F2		
C1138	B2			R1150	E1	R1176	G2	VR1130	D2
C1160	E1	R1105	F2	R1152	E1	R1178	G2	VR1162	E1
C1162	F2	R1106	D2	R1155	E1	R1190	A1	VR1190	B2
C1190	E2	R1110	E2	R1156	E1	R1194	A2	VR1194	B2
C1194	D2	R1115	A1						
C1195	F1	R1118	A2						

THEORY OF OPERATION OPTION 4

The Sweep Generator circuit produces a positive-going sawtooth voltage that is amplified by the horizontal Deflection Amplifier to provide sweep deflection in the crt. Six sweep rates are provided, 0.1 s through 1 μs in decade steps. A negative-going gate is produced at the same time the sawtooth is being produced to unblank the crt.

The Sweep Generator circuit is a Tektronix integrated circuit, U1130, and its associated discrete circuit components. The active circuits in the IC include the trigger generator, the sweep-gating circuit, and an operational amplifier to form the basis of a miller integrator. Power is applied to pins 7 and 12 to establish the operating levels within the device. An internal reference Zener provides 6.4 volts between pins 8 and 9 for operation of external controls; pin 8 provides a level two diode junctions above the negative level at pin 12.

The timing rc components are selected by SEC/DIV switch S1130, permitting one of six nominal sweep rates to be chosen. VARIABLE potentiometer R1145 provides an adjustment of the timing current to produce a continuously variable sweep rate.

SWEEP OUTPUT AMPLIFIER

Operational amplifier system Q1160-Q1164 provides amplification of the sweep sawtooth to a suitable amplitude to meet the sensitivity requirements of the Deflection Amplifier. R1165, Sweep Cal, permits calibrating the sweep to the crt graticule. The base of Q1160 is the null point, R1150 is the R_{in} element, and R1155 is the feedback element. A positive-going sawtooth is produced at the emitter of Q1164.

UNBLANKING GATE OUTPUT

The negative-going gate produced at pin 16 of U1130 is amplified by Q1175 and Q1178. The negative-going gate produced at the collector of Q1178 is applied to R735 in the crt grid circuit to turn on the crt during the sweep.

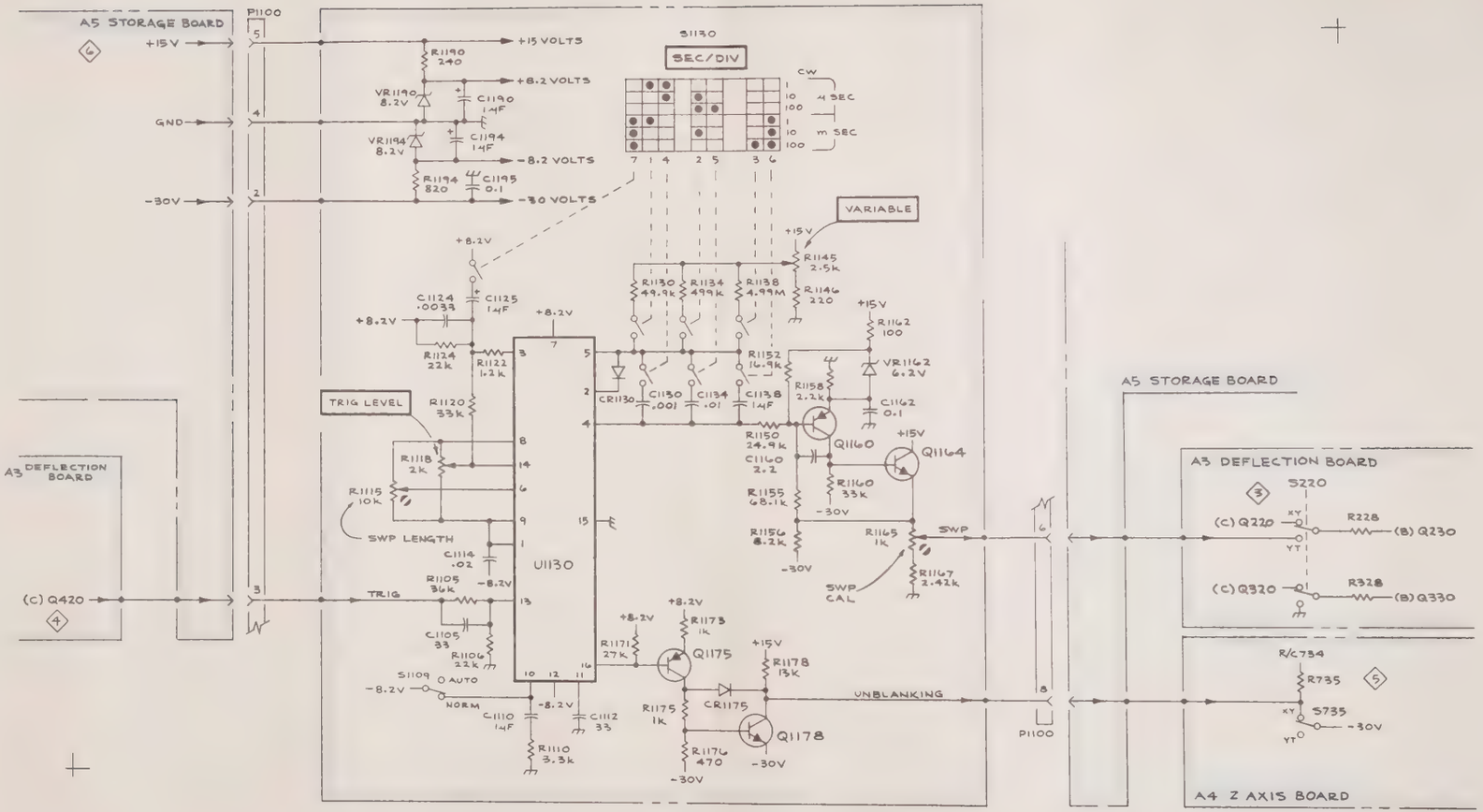
TRIGGER GENERATOR

Pins 10, 11, 13, and 14 are associated with the trigger generator portion of U1130. The triggering signal is applied to a field effect transistor (fet) input at pin 13. The TRIG SLOPE/LEVEL potentiomter R1118 at pin 14 controls the internal comparators that determine the level and slope at which the internal Schmitt multivibrator switches states, initiating a sweep trigger. Differentiating capacitor C1112 at pin 11 determines the trigger-pulse width.

For normal triggered operation, −8.2 volts is applied to pin 10 to hold the bright baseline auto circuit inactive. In this mode, when the triggering signal is lost, a sweep cannot be produced. When internal Auto-Norm switch S1109 is set to Auto, the −8.2 volts is disconnected to permit a free-running sweep, or bright baseline, to be produced. Pin 10 moves positive as C1110 charges, and this positive potential replaces the incoming triggering signal. A new sweep will be initiated immediately following the sweep holdoff time. However, in the auto mode, any incoming triggering signal will discharge C1110; if the signal is occurring at a rate greater than about 20 hertz, C1110 will be held below the auto-trigger level, permitting a triggered sweep to be produced.

SWEEP GATE AND MILLER INTEGRATOR

Pins 1, 2, 3, 4, 5, 6, and 16 are associated with the sweep generator portion of U1130. Upon receipt of a trigger from the trigger generator, the sweep gate turns on. While the gate is on, CR1130 is turned off by a high logic level at pin 2, allowing the current through external R_t components R1130-R1146 to be switched into the feedback timing capacitor C1130-C1138. Pin 5 is the operational amplifier null point, thus the nearly constant timing current charges the capacitor linearly, producing at pin 4 a linear, negative-going sawtooth voltage. When the sawtooth reaches a level determined by R1115, Sweep Length (pin 6), the sweep terminates. At this point, the sweep gate turns off, turning on CR1130 and quickly discharging the timing capacitor. A short-duration trigger-lockout period to allow the sweep generator to reset and stabilize is provided by C1124-C1125 at pin 3.



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SWEEP, OPTION 4

DEH 0474

Electrical Parts List

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A6	670-2278-00			CKT BOARD ASSY:SWEEP	80009	670-2278-00
C1105	281-0503-00			CAP.,FXD,CER DI:8PF,+/-0.5PF,500V	72982	301-000C0H0809D
C1110	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C1112	281-0629-00			CAP.,FXD,CER DI:33PF,5%,600V	71590	TC233
C1114	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	56289	5SC21A7
C1124	283-0041-00			CAP.,FXD,CER DI:0.0033UF,5%,500V	72982	841-000Z5D0332J
C1125	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C1130						
C1134 [1]	295-0159-00			CAP.SET,MTCHD:1.0UF,0.01UF,0.001UF MTCHD	80009	295-0159-00
C1138						
C1160	281-0604-00			CAP.,FXD,CER DI:2.2PF,+/-0.25PF,500V	72982	301-000C0J0229C
C1162	290-0572-00			CAP.,FXD,ELCTLT:0.1UF,20%,50V	56289	196D104X0050HA1
C1190	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C1194	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C1195	290-0572-00			CAP.,FXD,ELCTLT:0.1UF,20%,50V	56289	196D104X0050HA1
CR1130	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1175	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
Q1160	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249
Q1164	151-0341-00			TRANSISTOR:SILICON,NPN	07263	2N3565
Q1175	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249
Q1178	151-0190-00			TRANSISTOR:SILICON,NPN	04713	2N3904
R1105	315-0363-00			RES.,FXD,COMP:36K OHM,5%,0.25W	01121	CB3635
R1106	315-0223-00			RES.,FXD,COMP:22K OHM,5%,0.25W	01121	CB2235
R1110	316-0332-00			RES.,FXD,COMP:3.3K OHM,10%,025W	01121	CB3321
R1115	311-0607-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	80740	62-59-3
R1118	311-0949-00			RES.,VAR,NONWIR:2K OHM,10%,0.50W	01121	WA1G040S202UA
R1120	316-0333-00			RES.,FXD,COMP:33K OHM,10%,0.25W	01121	CB3331
R1122	316-0122-00			RES.,FXD,COMP:1.2K OHM,10%,0.25W	01121	CB1221
R1124	315-0223-00			RES.,FXD,COMP:22K OHM,5%,0.25W	01121	CB2235
R1130	321-0356-00			RES.,FXD,FILM:49.9K OHM,1%,0.125W	75042	CEAT0-4992F
R1134	321-0452-00			RES.,FXD,FILM:499K OHM,1%,0.125W	75042	CEAT0-4993F
R1138	307-0381-00			RES.,FXD,FILM:4.99M OHM,1%,0.50W	03888	FL12-499D34
R1145	311-0443-00			RES.,VAR,NONWIR:2500 OHM,20%,0.75W	11237	41330
R1146	315-0221-00			RES.,FXD,COMP:220 OHM,5%,0.25W	01121	CB2215
R1150	321-0327-00			RES.,FXD,FILM:24.9K OHM,1%,0.125W	75042	CEAT0-2492F
R1152	321-0311-00			RES.,FXD,FILM:16.9K OHM,1%,0.125W	75042	CEAT0-1692F
R1155	321-0369-00			RES.,FXD,FILM:68.1K OHM,1%,0.125W	75042	CEAT0-6812F
R1156	315-0822-00			RES.,FXD,COMP:8.2K OHM,5%,0.25W	01121	CB8225
R1158	316-0222-00			RES.,FXD,COMP:2.2K OHM,10%,0.25W	01121	CB2221
R1160	316-0333-00			RES.,FXD,COMP:33K OHM,10%,0.25W	01121	CB3331
R1162	316-0101-00			RES.,FXD,COMP:100 OHM,10%,0.25W	01121	CB1011
R1165	311-0635-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W	80740	62-56-3
R1167	321-0230-00			RES.,FXD,FILM:2.43K OHM,1%,0.125W	75042	CEAT0-2431F
R1171	315-0273-00			RES.,FXD,COMP:27K OHM,5%,0.25W	01121	CB2735
R1173	316-0102-00			RES.,FXD,COMP:1K OHM,10%,0.25W	01121	CB1021
R1175	316-0102-00			RES.,FXD,COMP:1K OHM,10%,0.25W	01121	CB1021
R1176	316-0471-00			RES.,FXD,COMP:470 OHM,10%,0.25W	01121	CB4711
R1178	315-0133-00			RES.,FXD,COMP:13K OHM,5%,0.25W	01121	CB1335
R1190	301-0241-00			RES.,FXD,COMP:240 OHM,5%,0.50W	01121	EB2415
R1194	303-0821-00			RES.,FXD,COMP:820 OHM,5%,1W	01121	GB8215
S1109	260-0960-01			SWITCH,SLIDE:0.5A,120VDC,CKT BD MT	80009	260-0960-01
S1130 [2]	105-0389-00			DRUM ASSY,CAM S:	80009	105-0389-00
U1130	155-0055-00			MICROCIRCUIT,LI:MONOLITHIC,TRIG & SWEEP	80009	155-0055-00
VR1162	152-0166-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	81483	69-9035
VR1190	152-0217-00			SEMICOND DEVICE:ZENER,400MW,8.2V,5%	07910	1N756A
VR1194	152-0217-00			SEMICOND DEVICE:ZENEP,400MW,8.2V,5%	07910	1N756A

[1] Individual timing capacitors in this assembly must be ordered by the 9 digit part number, letter suffix and tolerance printed on the timing capacitor to be replaced. The letter suffix and the tolerance should be the same for all of the timing capacitors in the assembly. EXAMPLE: 285-XXXX-XX F-

[2] See Mechanical Parts List for replacement parts.

OPTION 4

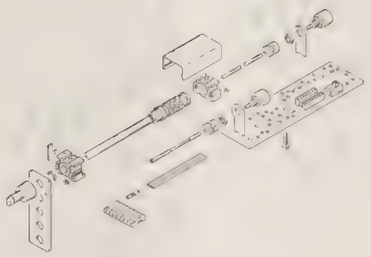


Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty 1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
2-1	333-2001-00			1	PANEL,FRONT:OPTION 4	80009	333-2001-00
-2	366-1360-00			1	KNOB:GRAY,W/SETSCREW	80009	366-1360-00
	179-2178-00			1	WIRING HARNESS:	80009	179-2178-00
-3	----- -----			1	CKT BOARD ASSY:SWEEP(SEE A6 EPL)		
	----- -----			-	. CKT BOARD ASSY INCLUDES:		
	131-0604-00			7	. CONTACT,ELEC:0.025 SQ X 0.365 INCH LONG	80009	131-0604-00
-4	136-0260-01			1	. SOCKET,SEMICOND:16 CONTACT,RECT SHAPE	71785	133-51-02-075
-5	352-0166-05			1	. HOLDER,TERM.CON:8 WIRE,GREEN	80009	352-0166-05
-6	131-0707-00			6	. CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
-7	175-0828-00			FT	. WIRE,ELECTRICAL:5 WIRE RIBBON	23499	TEK-175-0828-00
	175-1020-00			FT	. CABLE,RF:	90484	DAB70JAAAWHITE
-8	260-0960-01			1	. SWITCH,SLIDE:0.50A,120V		

OPTION 4 (CONT)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty 1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
2-9	376-0051-00			1	. CPLG,SHAFT,FLEX:FOR 0.125 INCH DIA SHAFTS	80009	376-0051-00
	----- -----			-	. . COUPLING SHAFT,FLEXIBLE INCLUDES:		
	354-0251-00			2	. . RING,COUPLING:	80009	354-0251-00
	376-0049-00			-	. . CPLG,SHAFT,FLEX:PLASTIC	80009	376-0049-00
	213-0022-00			4	. . SETSCREW:4-40 X 0.188 INCH,HEX SOC STL	74445	OBD
-10	376-0051-01			1	. CPLG,SHAFT,FLEX:FOR 0.125 INCH	80009	376-0051-01
	----- -----			-	. . COUPLING SHAFT,FLEXIBLE INCLUDES:		
	354-0251-00			1	. . RING,COUPLING:	80009	354-0251-00
	376-0049-00			1	. . CPLG,SHAFT,FLEX:PLASTIC	80009	376-0049-00
	213-0048-00			4	. . SETSCREW:4-40 X 0.125 INCH HEX SOC STL	74445	OBD
-11	384-0284-00			1	. EXTENSION SHAFT:5.688 INC LONG	80009	384-0284-00
-12	384-1156-00			1	. EXTENSION SHAFT:2.20 INCH LONG	80009	384-1156-00
-13	----- -----			1	. RES.VAR:(SEE R945 EPL)		
					(ATTACHING PARTS)		
-14	210-0583-00			1	. NUT,PLAIN,HEX.:0.25-32 X 0.312 INCH,BRS	73743	2X20319-402
	210-0590-00			1	. NUT,PLAIN,HEX.:0.375 X 0.438INCH,STL	73743	2X28269-402
-15	387-0794-00			1	. BRKT,VAR RES:BRS	80009	387-0794-00
-16	----- -----			1	. RES.,VAR:(SEE R918 EPL)		
					(ATTACHING PARTS)		
-17	210-0583-00			1	. NUT,PLAIN,HEX.:0.25-32 X 0.312 INCH,BRS	73743	2X20319-402
	210-0590-00			1	. NUT,PLAIN,HEX.:0.375 X 0.438INCH,STL	73743	2X28269-402
	386-2351-00			1	. PL,VAR RES MTG:	80009	386-2351-00
	105-0389-00			1	. DRUM ASSY,CAM S:	80009	105-0389-00
	----- -----			-	. . ACTUATOR ASSY INCLUDES:		
-18	200-1441-00			1	. . COVER,CAM .. 7 ELEMENTS	80009	200-1441-00
-19	354-0219-00			1	. . RING,RETAINING:FOR 0.25 INCH SHAFT	79136	5103-25-MD-R
-20	401-0155-00			1	. . BEARING,CAM SW:FRONT	80009	401-0155-00
-21	214-1704-00			-	. . SPRING,FLAT:CAM SW DETENT,0.006 INCH THK	80009	214-1704-00
	214-1704-01			-	. . SPRING,FLAT:CAM SW DETENT,0.008 INCH THK	80009	214-1704-01
	214-1704-02			-	. . SPRING,FLAT:CAM SW DETENT,0.010 INCH THK	80009	214-1704-02
-22	214-1127-00			1	. . ROLLER,DETENT:0.125 DIA X 0.125 INCH L	80009	214-1127-00
-23	105-0388-00			1	. . DRUM,CAM SWITCH:	80009	105-0388-00
-24	401-0156-00			1	. . BEARING,CAM SW:REAR	80009	401-0156-00
					(ATTACHING PARTS)		
-25	211-0116-00			4	. SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
					(ATTACHING PARTS)		
	211-0008-00			4	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD

REPLACEABLE MECHANICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

1 2 3 4 5 Name & Description

Assembly and/or Component
Attaching parts for Assembly and/or Component
- - - * - - -
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
- - - * - - -
Parts of Detail Part
Attaching parts for Parts of Detail Part
- - - * - - -

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol - - - * - - - indicates the end of attaching parts.

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

"	INCH
#	NUMBER SIZE
ACTR	ACTUATOR
ADPTR	ADAPTER
ALIGN	ALIGNMENT
AL	ALUMINUM
ASSEM	ASSEMBLED
ASSY	ASSEMBLY
ATTEN	ATTENUATOR
AWG	AMERICAN WIRE GAGE
BD	BOARD
BRKT	BRACKET
BRS	BRASS
BRZ	BRONZE
BSHG	BUSHING
CAB	CABINET
CAP	CAPACITOR
CER	CERAMIC
CHAS	CHASSIS
CKT	CIRCUIT
COMP	COMPOSITION
CONN	CONNECTOR
COV	COVER
CPLG	COUPLING
CRT	CATHODE RAY TUBE
DEG	DEGREE
DWR	DRAWER
ELCTRN	ELECTRON
ELEC	ELECTRICAL
ELCTLT	ELECTROLYTIC
ELEM	ELEMENT
EPL	ELECTRICAL PARTS LIST
EQPT	EQUIPMENT
EXT	EXTERNAL
FIL	FILLISTER HEAD
FLEX	FLEXIBLE
FLH	FLAT HEAD
FLTR	FILTER
FR	FRAME or FRONT
FSTNR	FASTENER
FT	FOOT
FXD	FIXED
GSKT	GASKET
HDL	HANDLE
HEX	HEXAGON
HEX HD	HEXAGONAL HEAD
HEX SOC	HEXAGONAL SOCKET
HLCPS	HELICAL COMPRESSION
HLEXT	HELICAL EXTENSION
HV	HIGH VOLTAGE
IC	INTEGRATED CIRCUIT
ID	INSIDE DIAMETER
IDENT	IDENTIFICATION
IMPLR	IMPELLER
IN	INCH
INCAND	INCANDESCENT
INSUL	INSULATOR
INTL	INTERNAL
LPHLDR	LAMPHOLDER
MACH	MACHINE
MECH	MECHANICAL
MTG	MOUNTING
NIP	NIPPLE
NON WIRE	NOT WIRE WOUND
OBD	ORDER BY DESCRIPTION
OD	OUTSIDE DIAMETER
OVH	OVAL HEAD
PH BRZ	PHOSPHOR BRONZE
PL	PLAIN or PLATE
PLSTC	PLASTIC
PN	PART NUMBER
PNH	PAN HEAD
PWR	POWER
RCPT	RECEPTACLE
RES	RESISTOR
RGD	RIGID
RLF	RELIEF
RTNR	RETAINER
SCH	SOCKET HEAD
SCOPE	OSCILLOSCOPE
SCR	SCREW
SE	SINGLE END
SECT	SECTION
SEMICOND	SEMICONDUCTOR
SHLD	SHIELD
SHLDR	SHOULDERED
SKT	SOCKET
SL	SLIDE
SLFLKG	SELF-LOCKING
SLVG	SLEEVING
SPR	SPRING
SQ	SQUARE
SST	STAINLESS STEEL
STL	STEEL
SW	SWITCH
T	TUBE
TERM	TERMINAL
THD	THREAD
THK	THICK
TNSN	TENSION
TPG	TAPPING
TRH	TRUSS HEAD
V	VOLTAGE
VAR	VARIABLE
W/	WITH
WSHR	WASHER
XFMR	TRANSFORMER
XSTR	TRANSISTOR

CROSS INDEX MFR. CODE NUMBER TO MANUFACTURER

MFR.CODE	MANUFACTURER	ADDRESS	CITY,STATE,ZIP
00000	Gettig Engineering and Manufacturing Co.		Springmill, PA 16875
00779	AMP, Inc.	P. O. Box 3608	Harrisburg, PA 17105
01009	Alden Products Co.	117 N. Main St.	Brockton, MA 02403
01295	Texas Instruments, Inc., Semiconductor Group	P. O. Box 5012	Dallas, TX 75222
05820	Wakefield Engineering, Inc.	Audubon Road	Wakefield, MA 01880
07111	Pneumo Dynamics Corp.	4800 Prudential Tower	Boston, MA 44103
08261	Spectra-Strip Corp.	7100 Lampson Ave.	Garden Grove, CA 92642
10889	Chicago Switch, Inc.	2035 Wabansia Ave.	Chicago, IL 60647
12327	Freeway Corp.	9301 Allen Dr.	Cleveland, OH 44125
22526	Berg Electronics, Inc.	Youk Expressway	New Cumberland, PA 17070
23499	Gavitt Wire and Cable, Division of RSC Industries, Inc.	455 N. Quince St.	Escondido, CA 92025
24931	Specialty Connector Co., Inc.	3560 Madison Ave.	Indianapolis, IN 46227
70485	Atlantic India Rubber Works, Inc.	571 W. Polk St.	Chicago, IL 60607
71468	ITT Cannon Electric	666 E. Dyer Rd.	Santa Ana, CA 92702
71590	Centralab Electronics, Div. of Globe-Union, Inc.	5757 N. Green Bay Ave.	Milwaukee, WI 53201
71785	TRW Electronic Components, Cinch Connector Operations	1501 Morse Ave.	Elk Grove Village, IL 60007
73743	Fischer Special Mfg. Co.	446 Morgan St.	Cincinnati, OH 45206
74445	Helo-Krome Co.	31 Brook St. West	Hartford, CT 06110
75915	Littelfuse, Inc.	800 E. Northwest Hwy	Des Plaines, IL 60016
78189	Illinois Tool Works, Inc. Shakeproof Division	St. Charles Road	Elgin, IL 60120
78471	Tilley Mfg. Co.	900 Industrial Rd.	San Carlos, CA 94070
79136	Waldes, Kohinoor, Inc.	47-16 Austel Place	Long Island City, NY 11101
79807	Wrought Washer Mfg. Co.	2100 S. O Bay St.	Milwaukee, WI 53207
80009	Tektronix, Inc.	P. O. Box 500	Beaverton, OR 97077
81439	Therm-O-Disc, Inc.	1320 S. Main St.	Mansfield, OH 44907
82647	Texas Instruments, Inc., Control Products Div.	34 Forest St.	Attleboro, MA 02703
83385	Central Screw Co.	2530 Crescent Dr.	Broadview, IL 60153
83501	Gavitt Wire and Cable, Division of RSC Industries, Inc.	Central St.	Brookfield, MA 01506
83907	Accurate Rubber Products Co.	123 N. Racine	Chicago, IL 60607
90484	ITT, Surprenant Div.		Clinton, MA 01510
91929	Honeywell, Inc., Micro Switch Div.	Chicago & Spring Sts.	Freeport, IL 61032
95937	Federal Television Div., Cardwell Condenser Corp.	80 E. Montauk Hwy.	Lindenhurst, NY 11757
95987	Weckesser Co., Inc.	4444 West Irving Park Rd.	Chicago, IL 60641

FIGURE 1 EXPLODED

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
1-1	390-0270-00			1	CABINET SIDE:LEFT	80009	390-0270-00
	390-0244-00			1	CABINET SIDE:RIGHT	80009	390-0244-00
	214-0812-00			2	. FASTENER,PAWL:	80009	214-0812-00
-2	386-0226-00			1	. . PL,LATCH LKG:FOR 0.080 INCH THICKNESS	80009	386-0226-00
-3	386-0227-00			1	. . PL,LATCH INDEX:	80009	386-0227-00
-4	214-0604-00			1	. . WASH.,SPG TNSN:0.26 ID X 0.47INCH OD	80009	214-0604-00
-5	214-0603-01			1	. . PIN,SECURING:0.27 INCH LONG	80009	214-0603-01
-6	390-0280-00			1	CAB.BOTTOM:MONITOR	80009	390-0280-00
	390-0281-00			1	CAB.BOTTOM:OPT 3 ONLY	80009	390-0281-00
	214-0812-00			4	. FASTENER,PAWL:	80009	214-0812-00
-7	386-0226-00			1	. . PL,LATCH LKG:FOR 0.080 INCH THICKNESS	80009	386-0226-00
-8	386-0227-00			1	. . PL,LATCH INDEX:	80009	386-0227-00
-9	214-0604-00			1	. . WASH.,SPG TNSN:0.26 ID X 0.47INCH OD	80009	214-0604-00
-10	214-0603-01			1	. . PIN,SECURING:0.27 INCH LONG	80009	214-0603-01
-11	348-0074-00			2	. SPT PIVOT,FLIP:RIGHT FRONT &LEFT REAR	80009	348-0074-00
					(ATTACHING PARTS FOR EACH)		
-12	211-0532-00			2	. SCREW,MACHINE:6-32 X 0.75 INCH,FILH STL	83385	OBD
-13	210-0457-00			2	. NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
					- - - * - - -		
-14	348-0207-00			2	. FOOT CAB:RF & LR	80009	348-0207-00
-15	348-0073-00			2	. SPT PIVOT,FLIP:LEFT FRONT & RIGHT REAR	80009	348-0073-00
					(ATTACHING PARTS FOR EACH)		
	211-0532-00			2	. SCREW,MACHINE:6-32 X 0.75 INCH,FILH STL	83385	OBD
-16	210-0457-00			2	. NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
					- - - * - - -		
-17	348-0208-00			2	. FOOT CAB:LF & RR	80009	348-0208-00
-18	200-0728-00			2	COV,HANDLE END:	80009	200-0728-00
-19	367-0116-00			1	HANDLE,CARRYING:STRAP TYPE	80009	367-0116-00
					(ATTACHING PARTS)		
-20	212-0597-00			4	SCREW,MACHINE:10-32 X 0.50 INCH,STL	80009	212-0597-00
-21	386-1624-00			2	PL,RET.,HANDLE:	80009	386-1624-00
-22	386-1283-00			2	PL,HANDLE MTG:FRONT	80009	386-1283-00
					- - - * - - -		
-23	348-0275-00			1	FLIPSTAND,CAB:	80009	348-0275-00
-24	200-1661-00			1	BEZEL,CRT:FOR 605	80009	200-1661-00
					(ATTACHING PARTS)		
-25	211-0188-00			2	SCREW,MACHINE:4-40 X 0.30"INCH,SST	80009	211-0188-00
					- - - * - - -		
	343-0298-00			1	CLAMP,LOOP:PLASTIC,W/ADHESIVE BACK	95937	HPC25
-26	337-1674-06			1	SHLD,ELCTRN TUB:CRT	80009	337-1674-06
-27	386-2340-00			4	SUPPORT,CRT:FRONT	80009	386-2340-00
-28	386-2899-00			1	SUPPORT,CRT:FRONT	80009	386-2899-00
-29	384-1270-00			1	SHAFT,EXT:PWR ON SW	80009	384-1270-00
-30	358-0216-00			1	BUSHING,PLASTIC:0.257 ID X 0.412 INCH OD	80009	358-0216-00
-31	376-0127-00			1	COUPLER,SHAFT:PLASTIC	80009	376-0127-00
-32	385-0033-00			1	INS,STANDOFF:0.625 INCH LONG,NYLON	80009	385-0033-00
					(ATTACHING PARTS)		
-33	211-0538-00			1	SCREW,MACHINE:6-32 X 0.312"100 DEG,FLH STL	83385	OBD
					- - - * - - -		
-34	260-1222-00			1	SWITCH,PUSH-PUL:10A,250VAC	91929	2DM301
-35	200-1282-00			1	DOOR,ACCESS,PNL:	80009	200-1282-00
-36	333-1875-00			1	PANEL,FRONT:	80009	333-1875-00
					(ATTACHING PARTS)		
-37	210-0406-00			3	NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS	73743	2X12161-402
-38	210-0054-00			3	WASHER,LOCK:SPLIT,0.118 ID X 0.212"OD STL	83385	OBD
					- - - * - - -		
-39	366-1023-01			1	KNOB:GRAY	80009	366-1023-01
	213-0153-00			1	. SETSCREW:5-40 X 0.125 INCH,HEX SOC STL	74445	OBD
-40	366-1257-84			1	PUSH BUTTON:GRAY--ERASE	80009	366-1257-84
	366-1257-85			1	PUSH BUTTON:GRAY--STORE	80009	366-1257-85
-41	426-0681-00			2	FR,PUSH BUTTON:GRAY PLASTIC	80009	426-0681-00
-42	----- -----			1	RES.,VAR:(SEE R895 EPL)		
					(ATTACHING PARTS)		
-43	210-0583-00			1	NUT,PLAIN,HEX.:0.25-32 X 0.312 INCH,BRS	73743	2X20319-402
	210-0940-00			1	WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL	79807	OBD
-44	210-0046-00			1	WASHER,LOCK:INTL,0.26 ID X 0.40" OD,STL	78189	1214-05-00-0541C
					- - - * - - -		

FIGURE 1 EXPLODED (CONT)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
1-45	333-1876-00			1	PANEL,FRONT:	80009	333-1876-00
-46	386-2067-00			1	SUBPANEL,FRONT:FOR 605	80009	386-2067-00
-47	334-1379-00			1	LABEL:CRT,ADHESIVE BACK	80009	334-1379-00
-48	348-0064-00			1	GROMMET,PLASTIC:0.625 INCH DIA	80009	348-0064-00
-49	348-0253-00			1	GROMMET,PLASTIC:1.24 X 0.739 X 0.108" OA	80009	348-0253-00
-50	337-1998-00			1	SHIELD,CRT:FRONT	80009	337-1998-00
					(ATTACHING PARTS)		
-51	210-0586-00			2	NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
	211-0116-00			2	SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
					- - - * - - -		
-52	----- -----			1	COIL:TRACE ROTATION(SEE L145 EPL)		
-53	337-1986-00			1	SHIELD,SECT,CRT:REAR	80009	337-1986-00
	----- -----	XB010190		1	COIL,TUBE DEFLE:(SEE L175 EPL)		
					(ATTACHING PARTS)		
	211-0147-00	XB010190		2	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
	343-0217-00	XB010190		1	CLAMP,COIL:	80009	343-0217-00
	348-0004-00	XB010190		1	GROMMET,RUBBER:	70485	763
-54	348-0145-00			1	GROMMET,PLASTIC:U-SHP,1.0 X 0.42 INCH	80009	348-0145-00
-55	386-2246-00			1	SUPPORT,CRT:REAR	80009	386-2246-00
-56	386-2876-00			1	SUPPORT,CRT:CENTER	80009	386-2876-00
-57	407-1128-00			1	BRKT,CRT SHIELD:REAR	80009	407-1128-00
					(ATTACHING PARTS)		
-58	220-0419-00			3	NUT,PLAIN,SQ:6-32 X 0.312 INCH,STL	83385	OBD
-59	211-0589-00			1	SCREW,MACHINE:6-32 X 0.312 INCH,PNH BRS	83385	OBD
	211-0507-00			2	SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
					- - - * - - -		
-60	161-0033-12			1	CABLE ASSY,PWR:	80009	161-0033-12
-61	200-1646-00			1	CABLE,NIPPLE,EL:	80009	200-1646-00
-62	214-2038-00			1	IND,LINE V:FOR 605	80009	214-2038-00
-63	358-0515-00			1	BSHG,STRAIN RLF:TOP	80009	358-0515-00
-64	358-0516-00			1	BSHG,STRAIN RLF:BOTTOM	80009	358-0516-00
-65	352-0076-00			1	FUSEHOLDER:W/HARDWARE	75915	342012
					(ATTACHING PARTS)		
-66	210-0873-00			1	WASHER,NONMETAL:0.5 ID X 0.688 INCH OD,NPRN	70485	OBD
					- - - * - - -		
-67	200-1308-00			1	COVER,CRT:REAR	80009	200-1308-00
					(ATTACHING PARTS)		
-68	211-0097-00			5	SCREW,MACHINE:4-40 X 0.312 INCH,PNH STL	83385	OBD
					- - - * - - -		
-69	210-0201-00			1	TERMINAL,LUG:SE #4	78189	2104-04-00-2520N
					(ATTACHING PARTS)		
-70	210-0586-00			1	NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
					- - - * - - -		
-71	200-0616-01			1	COV,ELECTRON TU:	80009	200-0616-01
-72	136-0596-00			1	SOCKET ASSY,CRT:FOR 605	80009	136-0596-00
-73	136-0301-01			1	. SOCKET,PLUG-IN:	80009	136-0301-01
	195-0135-00			1	LEAD SET,CRT DE:	80009	195-0135-00
-74	346-0045-00			3	STRAP,CONN COV:	80009	346-0045-00
-75	200-0991-00			3	COV,ELEC CONN:	80009	200-0991-00
-76	131-0955-00			6	CONNECTOR,RCPT,:BNC,FEMALE	24931	28JR200-1
					(ATTACHING PARTS)		
-77	210-0255-00			6	TERMINAL,LUG:0.391" ID INT TOOTH	80009	210-0255-00
					- - - * - - -		
-78	342-0117-00			12	INSULATOR,BUSH:BNC	80009	342-0117-00
-79	----- -----			1	RES.,VAR:(SEE R145 EPL)		
					(ATTACHING PARTS)		
-80	210-0583-00			1	NUT,PLAIN,HEX.:0.25-32 X 0.312 INCH,BRS	73743	2X20319-402
-81	210-0940-00			1	WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL	79807	OBD
	210-0046-00			1	WASHER,LOCK:INTL,0.26 ID X 0.40" OD,STL	78189	1214-05-00-0541C
					- - - * - - -		
-82	333-1829-00			1	PANEL,REAR:FOR 605	80009	333-1829-00

FIGURE 1 EXPLODED (CONT)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
1-83	----- -----			1	TRANSFORMER:(SEE T15 EPL)		
					(ATTACHING PARTS)		
-84	212-0100-00			4	SCREW,MACHINE:8-32 X 0.625 INCH,HEX.HD,STL	83385	NOTE
-85	343-0267-00			2	BRKT,HOLD DOWN:TRANSFORMER	80009	343-0267-00
	210-0804-00			4	WASHER,FLAT:0.17 ID X 0.375 INCH OD,STL	12327	OBD
-86	210-0458-00			4	NUT,PLAIN,EXT W:8-32 X 0344 INCH,STL	83385	OBD
					- - - * - - -		
-87	337-2006-00			1	SHLD,ELECTRICAL:HIGH VOLTAGE	80009	337-2006-00
					(ATTACHING PARTS)		
-88	211-0008-00			2	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
-89	----- -----			1	CKT BOARD ASSY:FRONT PANEL CONTROL		
	----- -----			-	STORAGE BOARD(SEE A5 EPL)		
-90	131-0566-00			1	. LINK,TERM.CONNE:0.086 DIA X 2.375 INCH L	0000C	L-2007-1
-91	131-0608-00			18	. CONTACT,ELEC:0.365 INCH LONG	22526	47357
-92	----- -----			1	. RES.,VAR:(SEE R175A,B EPL)		
-93	131-1635-00			1	. CONTACT,ELEC:GND	80009	131-1635-00
-94	----- -----			2	. RES.,VAR:(SEE R240,R440 EPL)		
-95	----- -----			1	. RES.,VAR:(SEE R970 EPL)		
-96	136-0269-02			4	. SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402
-97	214-0579-00			3	. TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-98	260-1211-00			1	. SWITCH,PUSH:DPDT,PUSH-PUSH	71590	2KAB010000-357
-99	361-0383-00			2	. SPACER,PB SW:CHARCOAL,0.33 INCH LONG	80009	361-0383-00
-100	260-1308-00			1	. SWITCH,PUSH:MOMENTARY	71590	2KAA010000-440
	175-0827-00			FT	. WIRE,ELECTRICAL:4 WIRE RIBBON	08261	TEK-175-0827-00
	175-0828-00			FT	. WIRE,ELECTRICAL:5 WIRE RIBBON	23499	TEK-175-0828-00
	175-0829-00			FT	. WIRE,ELECTRICAL:6 WIRE RIBBON	83501	TEK-175-0829-00
					(ATTACHING PARTS)		
-101	211-0008-00			5	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
-102	366-1369-00			1	KNOB:W/SETSCREW	80009	366-1369-00
-103	366-1432-00			3	KNOB:GRAY,PUSH-ON MT	80009	366-1432-00
-104	----- -----			1	CKT BOARD ASSY:HIGH VOLTAGE(SEE A2 EPL)		
-105	124-0118-00			1	. TERMINAL BOARD:1 NOTCH	80009	124-0118-00
-106	355-0046-00			1	. MOUNT,TERM. BD:0.577 INCH H	80009	355-0046-00
-107	361-0007-00			1	. . SPACER,SLEEVE:0.250 INCH DIA,PLASTIC	80009	361-0007-00
-108	136-0514-00			1	. . SOCKET,PLUG-IN:MICROCIRCUIT,8 CONTACT	82647	C930802
-109	344-0154-00			2	. . CLIP,ELECTRICAL:FOR 0.25 INCH DIA FUSE	80009	344-0154-00
	175-0830-00			FT	. . WIRE,ELECTRICAL:7 WIRE RIBBON	08261	TEK-175-0830-00
					(ATTACHING PARTS)		
-110	211-0008-00			3	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
-111	----- -----			1	CKT BOARD ASSY:Z AXIS(SEE A4 EPL)		
-112	136-0252-04			6	. CONTACT,ELEC:0.188 INCH LONG	22526	75060
-113	214-0579-00			9	. TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-114	214-1291-00			2	. HEAT SINK,ELEC:XSTR,0.72 OD X 0.375"H	05820	OBD
	260-0723-00[1]			1	. SWITCH,SLIDE:DPDT,0.5A,125VAC	80009	260-0723-00
-115	351-0280-00			2	. GUIDE-POST,LOCK:0.620 INCH LONG	80009	351-0280-00
	131-0566-00[2]			2	. LINK,TERM.CONNE:0.086 DIA X 2.375 INCH L	0000C	L-2007-1
					(ATTACHING PARTS)		
	211-0008-00			2	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
-116	----- -----			1	CKT BOARD ASSY:DEFLECTION(SEE A3 EPL)		
-117	136-0252-01			8	. CONTACT,ELEC:0.178 INCH LONG	00779	1-332095-2
	136-0252-04			12	. CONTACT,ELEC:0.188 INCH LONG	22526	75060
-118	214-1291-00			2	. HEAT SINK,ELEC:XSTR,0.72 OD X 0.375"H	05820	OBD
-119	260-0723-00			4	. SWITCH,SLIDE:DPDT,0.5A,125VAC	80009	260-0723-00
	260-0723-00[1]			1	. SWITCH,SLIDE:DPDT,0.5A,125VAC	80009	260-0723-00
-120	337-1995-00			1	. SHIELD,ELEC:DEFLECTION	80009	337-1995-00
	175-0827-00			FT	. WIRE,ELECTRICAL:4 WIRE RIBBON	08261	TEK-175-0827-00
	131-0566-00[2]			2	. LINK,TERM.CONNE:0.086 DIA X 2.375 INCH L	0000C	L-2007-1
					(ATTACHING PARTS)		
-121	211-0008-00			2	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		

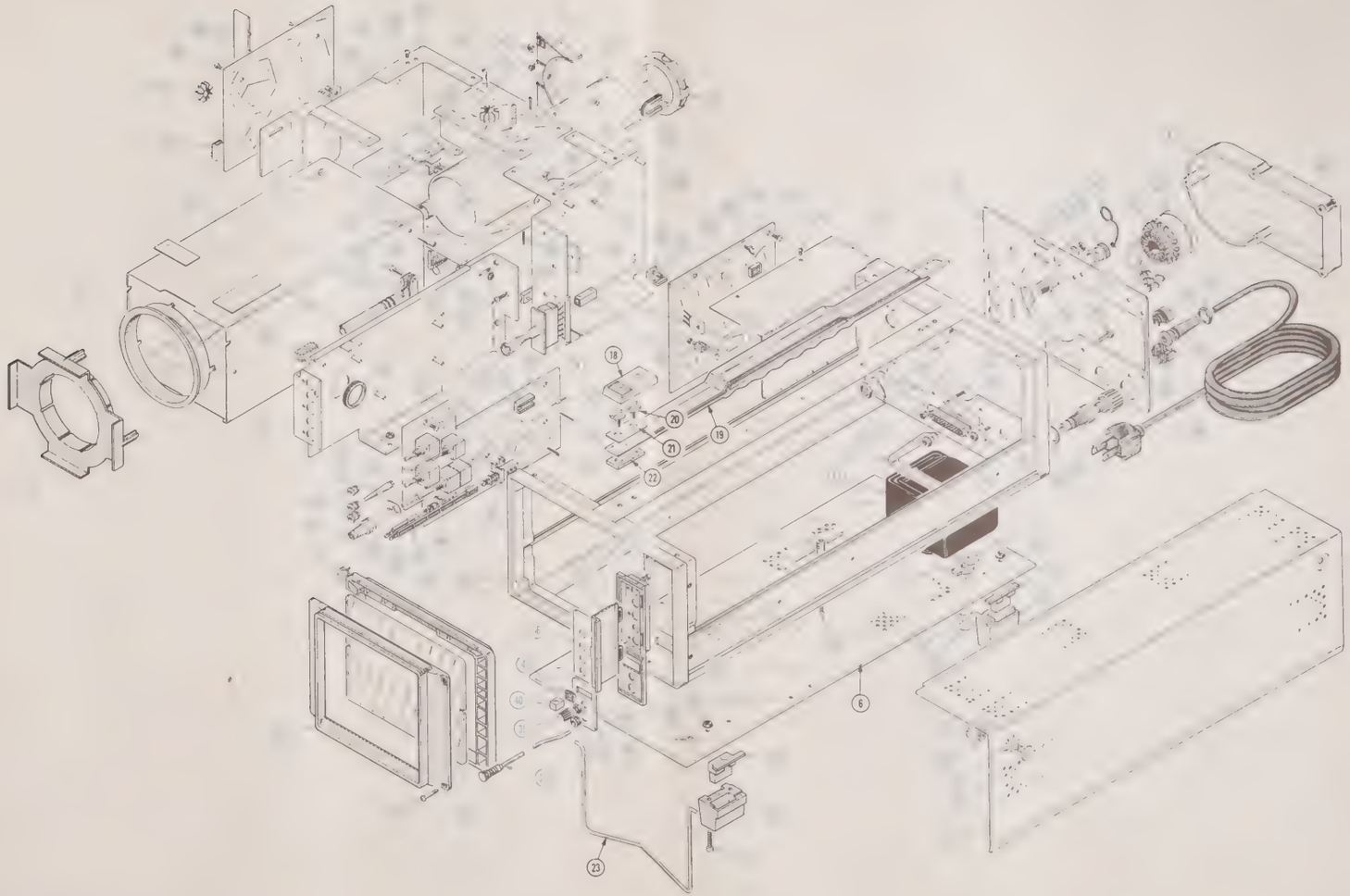
[1]Option 4 only.
[2]Standard instrument only.

FIGURE 1 EXPLODED (CONT)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-122	----- -----			1		CKT BOARD ASSY:LV POWER(SEE A1 EPL)		
-123	131-0608-00			14		. CONTACT,ELEC:0.365 INCH LONG	22526	47357
	344-0154-00			2		. CLIP,ELECTRICAL:FOR 0.25 INCH DIA FUSE	80009	344-0154-00
	131-0707-00			8		. CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
-124	352-0166-01			2		. HOLDER,TERM.CON:8 WIRE BROWN	80009	352-0166-01
	343-0213-00			1		. CLAMP,LOOP:PRESS MT,PLASTIC	80009	343-0213-00
						(ATTACHING PARTS)		
-125	211-0008-00			2		SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
						- - - * - - -		
-126	441-1222-00			1		CHAS,MONITOR:DEFLECTION	80009	441-1222-00
-127	344-0133-00			2		. CLIP,SPR,TNSN:CIRCUIT BOARD MOUNTING	80009	344-0133-00
-128	210-0659-01			2		. EYELET,METALLIC:0.121 OD X 0.156 INCH LONG	80009	210-0659-01
						(ATTACHING PARTS)		
-129	211-0025-00			2		SCREW,MACHINE:4-40 X 0.375 100 DEG,FLH STL	83385	OBD
	211-0114-00			1		SCREW,MACHINE:4-40 X 0.438 INCH,FLH STL	83385	OBD
	210-0586-00			3		NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
	211-0538-00			2		SCREW,MACHINE:6-32 X 0.312"100 DEG,FLH STL	83385	OBD
						- - - * - - -		
-130	441-1223-00			1		CHAS,MONITOR:HV	80009	441-1223-00
						(ATTACHING PARTS)		
-131	211-0008-00			2		SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
	211-0538-00			3		SCREW,MACHINE:6-32 X 0.312"100 DEG,FLH STL	83385	OBD
	210-0457-00			3		NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
						- - - * - - -		
	----- -----			-		. CHASSIS INCLUDES:		
-132	344-0131-00			2		. CLIP,SPG TENS:CIRCUIT BOARDMOUNTING	80009	344-0131-00
-133	210-0659-01			2		. EYELET,METALLIC:0.121 OD X 0.156 INCH LONG	80009	210-0659-01
-134	351-0087-00			1		GUIDE,CKT CARD:4.75 INCH LONG,PLASTIC	80009	351-0087-00
-135	----- -----			1		TRANSISTOR:(SEE Q130 EPL)		
-136	343-0521-00			1		CLAMP,XSTR:4-40 THD HOLE	80009	343-0521-00
						(ATTACHING PARTS)		
-137	211-0014-00			1		SCREW,MACHINE:4-40 X 0.50 INCH,PNH STL	83385	OBD
						- - - * - - -		
-138	260-0413-00			1		SW,THERMOSTATIC:10A,240V	81439	36T2L S#3779
						(ATTACHING PARTS)		
-139	210-0586-00			2		NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
						- - - * - - -		
-140	407-1498-00			1		BRACKET,ANGLE:POWER SUPPLY	80009	407-1498-00
						(ATTACHING PARTS)		
	211-0008-00			2		SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
	210-0586-00			2		NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
						- - - * - - -		
-141	----- -----			3		TRANSISTOR:(SEE Q30,Q60,Q70 EPL)		
-142	342-0082-00			3		INSULATOR,PLATE:0.52 SQ X 0.015 INCH THK,AL	80009	342-0082-00
-143	344-0236-00			3		CLIP,SPG TENS:TRANSISTOR MTG	80009	344-0236-00
-144	441-1224-00			1		CHAS,MONITOR:STORAGE	80009	441-1224-00
						(ATTACHING PARTS)		
	211-0538-00			2		SCREW,MACHINE:6-32 X 0.312"100 DEG,FLH STL	83385	OBD
-145	210-0457-00			2		NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
						- - - * - - -		
-146	348-0051-00			1		GROMMET,RUBBER:0.938 INCH DIA	83907	1107
-147	343-0006-00			1		CLAMP,LOOP:0.50 INCH DIAMETER,PLSTC	95987	1-2-6B
						(ATTACHING PARTS)		
-148	211-0014-00			1		SCREW,MACHINE:4-40 X 0.50 INCH,PNH STL	83385	OBD
-149	210-0863-00			1		WSHR,LOOP CLAMP:FOR 0.50" WIDE CLAMP,STL	95987	C191
	210-0994-00			1		WASHER,FLAT:0.125 ID X 0.25" OD,STL	83385	OBD
						- - - * - - -		
-150	166-0038-00	B010100 B010160		1		SPACER,SLEEVE:0.181ID X 0.250OD X 0.750" L	80009	166-0038-00
	384-0539-00	B010161		1		ROD,SPACER:0.375 X 0.750 INCH	80009	384-0539-00
						(ATTACHING PARTS)		
-151	211-0145-00	B010100 B010160		1		SCREW,MACHINE:4.40 X 1 INCH,PNH BRS	83385	OBD
	211-0231-00	B010161		1		SCREW,MACHINE:4-40 X 1 INCH,PNH SST	07111	OBD
	210-0958-00	XB010161		1		WASHER,FLAT:0.115 ID X 0.469 INCH OD,STL	78471	OBD
	210-1001-00	XB010161		1		WASHER,FLAT:0.119 ID X 0.375" OD,BRS	83385	OBD
-152	210-0586-00			2		NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
						- - - * - - -		

FIGURE 1 EXPLODED (CONT)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-153	131-0569-00			1		CONNECTOR,RCPT,:25 PIN,FEMALE	71468	DB25S
						(ATTACHING PARTS)		
-154	211-0101-00			2		SCREW,MACHINE:4-40 X 0.25" 100 DEG,FLH STL	83385	OBD
-155	210-0004-00			2		WASHER,LOCK:INTL,0.12 ID X 0.26"OD,STL	78189	1204-00-00-0541C
-156	210-0406-00			2		NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS	73743	2X12161-402
						- - - * - - -		
-157	384-1061-00			1		EXTENSION SHAFT:3.981 INCH LONG	80009	384-1061-00
-158	384-1099-00			1		EXTENSION SHAFT:PUSH BUTTON,1.54 INCH LONG	80009	384-1099-00
-159	384-1121-00			1		EXTENSION SHAFT:1.41 INCH LONG	80009	384-1121-00
-160	131-0773-00			1		LEAD,ELECTRICAL:18 INCH,W/30KVDC RATING	01009	8111LF
-161	426-1111-00			1		FR ASSY,MONITOR:FOR 605	80009	426-1111-00
	179-2163-00			1		WIRING HARNESS:POWER	80009	179-2163-00
	175-0825-00			FT		WIRE,ELECTRICAL:2 WIRE RIBBON	23499	TEK-175-0825-00
	175-0828-00			FT		WIRE,ELECTRICAL:5 WIRE RIBBON	23499	TEK-175-0828-00
-162	200-1075-00			1		COVER,ELEC CONN:PLASTIC	00779	1-480435-0
	334-2359-00			1		LABEL:WARNING POWER LINE POTENTIAL ON THIS BD	80009	334-2359-00
	334-2360-00	XB010190		1		LABEL:WARNING UP TO 250V ON THIS BOARD	80009	334-2360-00
	334-2361-00	XB010190		1		LABEL:WARNING UP TO 80 V ON THIS BOARD	80009	334-2361-00
	334-2363-00			1		LABEL:DANGER HIGH VOLTGE	80009	334-2363-00
	334-2433-00	XB010190		1		MARKER,IDENT:MARKED WARNING	80009	334-2433-00



Delete black reference numbers for Option 3 only.

ACCESSORIES

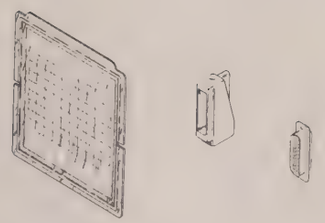


Fig. & Index No.	Tektronix Part No	Serial/Model No. Eff	Dscont	Qty 1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
2-	070-1679-00			1	MANUAL,TECH:INSTRUCTION	80009	070-1679-00
-1	131-0570-00			1	CONN,RECPT,ELEC:25 PIN MALE	71468	DB25P
-2	200-0821-00			1	COVER,ELEC.CONN:25 PIN	09111	DB-51213-1
-3	331-0391-00			1	GRATICULE,CRT:	80009	331-0391-00

REPACKAGING

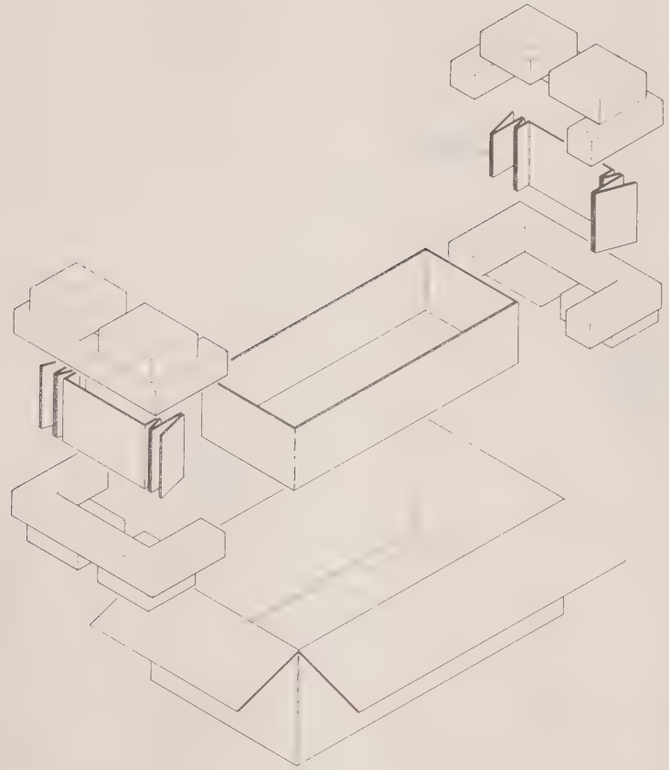


Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty 1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
2-	065-0150-00			1	CARTON ASSY:	80009	065-0150-00
	- - - - - -			-	CARTON ASSY INCLUDES:		
-4	004-0281-00			2	FRAME: TOP & BOTTOM	80009	004-0281-00
-5	004-1097-00			1	PAD SET: 3 PIECE	80009	004-1097-00
-6	004-0791-00			1	CARTON:	80009	004-0791-00

MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with latest electronic developments by adding circuit and component improvements to our instruments as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we can't get these changes immediately into printed manuals. Hence, your manual may contain new change information on following pages.

A single change may affect several sections. Sections of the manual are often printed at different times, so some of the information on the change pages may already be in your manual. Since the change information sheets are carried in the manual until ALL changes are permanently entered, some duplication may occur. If no such change pages appear in this section, your manual is correct as printed.

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MANUAL CHANGE INFORMATION

PRODUCT 605
070-1679-00

CHANGE REFERENCE C4/1074
DATE 10-25-74 REV.

CHANGE:	DESCRIPTION

ADJUSTMENTS

Step 2. ADJUST CRT OPERATION

ADD: Part e. as follows:

e. Orthogonality--R173

Connect 1 ms markers from the time marker generator to the +Y input connector and ground the -Y input connector.

Apply a sawtooth amplitude between +1 volt and +3 volts to the +X input connector and ground the -X input connector. Use a sweep rate of 1 ms/Div (for example use a RG 501 operating in a TM 500-Series Power Module).

Adjust R173 so that the vertical time markers make a 90° angle with the trace as observed at the graticule center. The adjustment of R173 may have to be compromised to make the angle as closely as possible to the desired 90°.

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MANUAL CHANGE INFORMATION

PRODUCT GENERAL

CHANGE REFERENCE S23351

DATE 4-10-75

CHANGE:	DESCRIPTION

POWER CORD CHANGES

The 1974 National Electrical Code permits the use of IEC (International Electrotechnical Commission) power cord color codes. As production permits, we are changing the entire Tektronix product line to comply with IEC power cord color code requirements. As a result, the power cord on Tektronix instruments may conform to either IEC or the older NEC requirements. The change consists of the following:

Conductor	NEC	IEC
Line	Black	Brown
Neutral	White	Light Blue*
Safety Earth	Green w/Yellow Stripe	Green w/Yellow Stripe

*Tinned copper conductor.

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MANUAL CHANGE INFORMATION

PRODUCT 605
070-1679-00

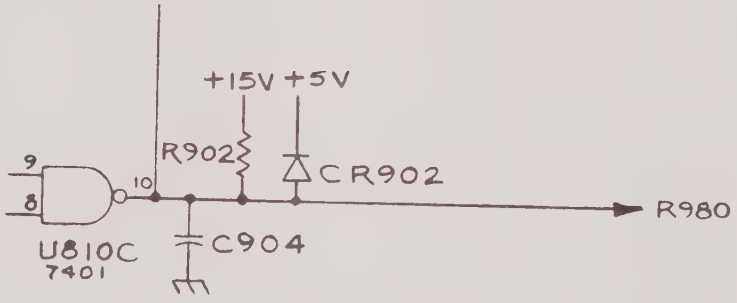
CHANGE REFERENCE C5/475
DATE 4-15-75

CHANGE:	DESCRIPTION

SCHEMATIC CORRECTION

DIAGRAM 6 DIAGRAM AND PARTS LOCATION GRID - Partial

(R902 goes to +15 V and CR902 goes to +5 V)



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MANUAL CHANGE INFORMATION

PRODUCT 605
EFF SN B020400-up

CHANGE REFERENCE M23,264
DATE 8-14-75

CHANGE:	DESCRIPTION

070-1679-00

ELECTRICAL PARTS LIST AND SCHEMATIC CHANGES

CHANGE TO:

A1	670-3125-01	CKT BOARD ASSY:LOW VOLTAGE
A3	670-3178-01	CKT BOARD ASSY:DEFLECTION
R40	311-1564-00	RES.,VAR,NONWIR:500 OHM,20%,0.50W
R438	315-0512-00	RES.,FXD,COMP:5.1K OHM,5%,0.25W

R40 is located on diagram 1, and R438 is located on diagram 4.

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MANUAL CHANGE INFORMATION

PRODUCT 605
070-1679-00

CHANGE REFERENCE M23,412
DATE 3-20-75

CHANGE:	DESCRIPTION

EFF SN B020310-up

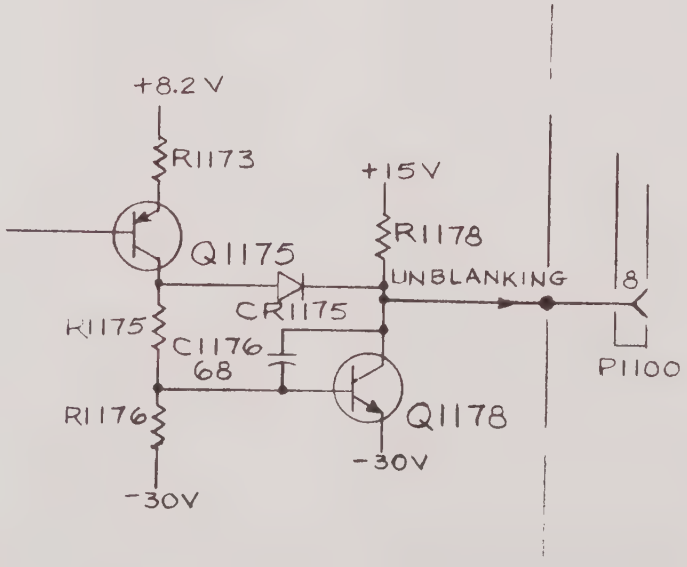
ELECTRICAL PARTS LIST AND SCHEMATIC CHANGE

OPTION 4 PARTS LISTS

ADD:

C1176	281-0549-00	CAP.,FXD,CER: DI:68PF, 10%, 500V

OPTION 4 THEORY & DIAGRAM - Partial



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MANUAL CHANGE INFORMATION

PRODUCT 605
EFF SN B020390-up

CHANGE REFERENCE M23,809
DATE 8-15-75

CHANGE:	DESCRIPTION

070-1679-00 ELECTRICAL PARTS LIST AND SCHEMATIC CHANGES

CHANGE TO:

Q32	151-0188-00	TRANSISTOR:SILICON,PNP	2N3906
Q50	151-0190-00	TRANSISTOR:SILICON,NPN	2N3904
Q64	151-0190-00	TRANSISTOR:SILICON,NPN	2N3904
Q76	151-0190-00	TRANSISTOR:SILICON,NPN	2N3904
Q80	151-0190-00	TRANSISTOR:SILICON,NPN	2N3904
Q220	151-0188-00	TRANSISTOR:SILICON,PNP	2N3906
Q230	151-0188-00	TRANSISTOR:SILICON,PNP	2N3906
Q232	151-0188-00	TRANSISTOR:SILICON,PNP	2N3906
Q260	151-0188-00	TRANSISTOR:SILICON,PNP	2N3906
Q320	151-0188-00	TRANSISTOR:SILICON,PNP	2N3906
Q330	151-0188-00	TRANSISTOR:SILICON,PNP	2N3906
Q332	151-0188-00	TRANSISTOR:SILICON,PNP	2N3906
Q360	151-0188-00	TRANSISTOR:SILICON,PNP	2N3906
Q420	151-0188-00	TRANSISTOR:SILICON,PNP	2N3906
Q430	151-0188-00	TRANSISTOR:SILICON,PNP	2N3906
Q432	151-0188-00	TRANSISTOR:SILICON,PNP	2N3906
Q460	151-0188-00	TRANSISTOR:SILICON,PNP	2N3906
Q520	151-0188-00	TRANSISTOR:SILICON,PNP	2N3906
Q530	151-0188-00	TRANSISTOR:SILICON,PNP	2N3906
Q532	151-0188-00	TRANSISTOR:SILICON,PNP	2N3906
Q560	151-0188-00	TRANSISTOR:SILICON,PNP	2N3906
Q620	151-0188-00	TRANSISTOR:SILICON,PNP	2N3906
Q630	151-0188-00	TRANSISTOR:SILICON,PNP	2N3906
Q640	151-0188-00	TRANSISTOR:SILICON,PNP	2N3906
Q670	151-0188-00	TRANSISTOR:SILICON,PNP	2N3906
Q680	151-0188-00	TRANSISTOR:SILICON,PNP	2N3906
Q690	151-0190-00	TRANSISTOR:SILICON,NPN	2N3904
Q700	151-0190-00	TRANSISTOR:SILICON,NPN	2N3904
Q710	151-0190-00	TRANSISTOR:SILICON,NPN	2N3904
Q810	151-0190-00	TRANSISTOR:SILICON,NPN	2N3904
Q1026	151-0190-00	TRANSISTOR:SILICON,NPN	2N3904

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